Volume 61

American Machinist

Number 18

New York, October 30, 1924

How the American Locomotive Company Machines Cylinders and Bushings

By L. C. Morrow

Managing Editor, *American Machinist*

Laying out cylinders for boring and planing—Machining operations—Testing hydraulically—Setting up and assembling the cylinders—Operations on cylinder and valve-chamber bushings

THE study of methods in connection with locomotive cylinders is at once fascinating and profitable. The cylinder is a heavy, expensive casting and approximately fourteen operations are necessary in making it ready to become a part of the locomotive. The most economical completion of cylinders is accomplished only when the number of operations is the lowest possible and when those operations are performed in the least amount of time.

It is probable that no one repair shop or locomotive-building shop has all of the best methods, and it is therefore advisable for the men responsible for methods and equipment in all shops to examine carefully the information concerning other shops when it is placed at their disposal. Through the courtesy of the Schenectady plant of the American Locomotive Co., the data presented here were made available. Cylinder and valve-chamber bushings become parts of the cylinder as a whole during its making and therefore they, as well as the cylinders, are treated.

On the table shown in Figs. 1 and 2 the cylinder castings are being laid out for planing the back and for boring the cylinder and valve chamber. The adjustable "center-sticks" should be noted.

Boring and facing the cylinder, operation 2, is done on Bement or Newton machines as shown in Fig. 3. The boring head carries three cutting tools and the slide of the facing head is operated by star feed. The output per day of nine hours is approximately two cylinders.

In planing the back and bottom, which is the third operation, and illustrated in Fig. 4, where the surfaces planed are marked *A*, location is done by means of the cylinder bore. A pair of cylinders is set up on two cast-iron drums that fit the bores exactly and extend from the cylinders to rest in V-supports, one of which can be seen. This arrangement provides for the parallelism of the back and bottom with the axis of the bore. Location with respect to the surfaces planed by the side head, and by vertical feed of the cross-rail head, is determined by gages. A knowledge of the blocking, supports, braces and clamps will be gained by studying the illustration. It will be noticed that the tool holder in the cross-rail head is of a section large

Sequence of Operations

Cylinder

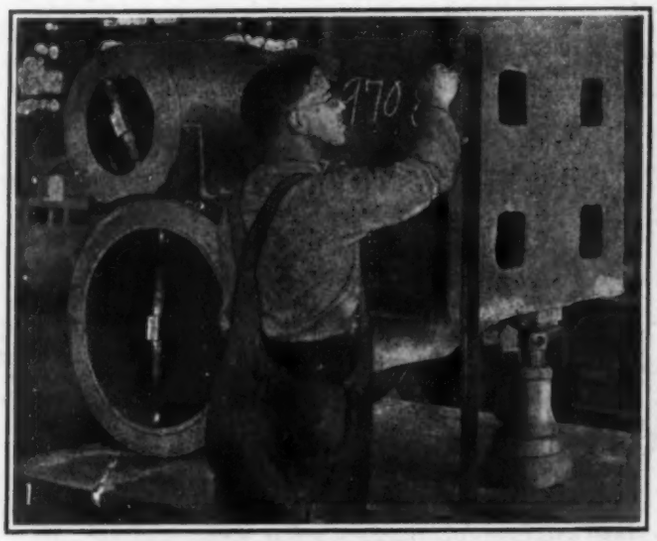
1—Layout back for planing and layout to bore
2—Bore and face cylinder
3—Plane back and bottom
4—Bore valve chamber
5—Drill and tap holes for test
6—Plug for test
7—Test hydraulically
8—Press in cylinder bushing
9—Press in valve-chamber bushing
10—Rebore cylinder bushing
11—Rebore valve-chamber bushing
12—Finish drilling (cylinder backs and frame-bolt holes)
13—Chip and clean, tap, fit and assemble
14—Cross plane (exhaust pipe seat and keyways)

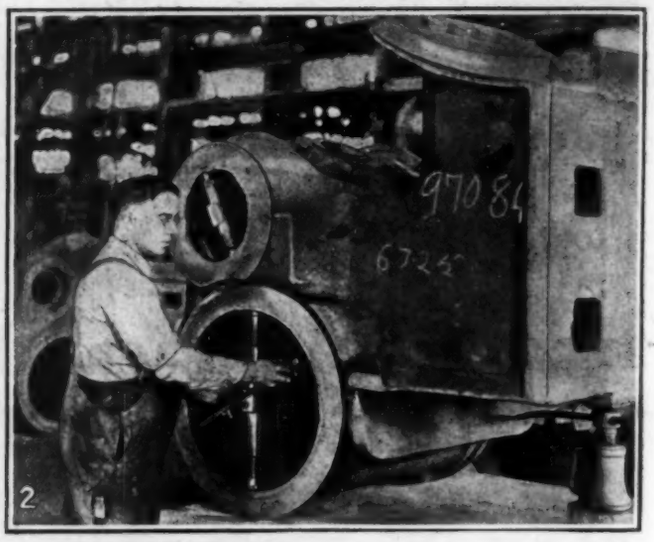
Cylinder Bushing

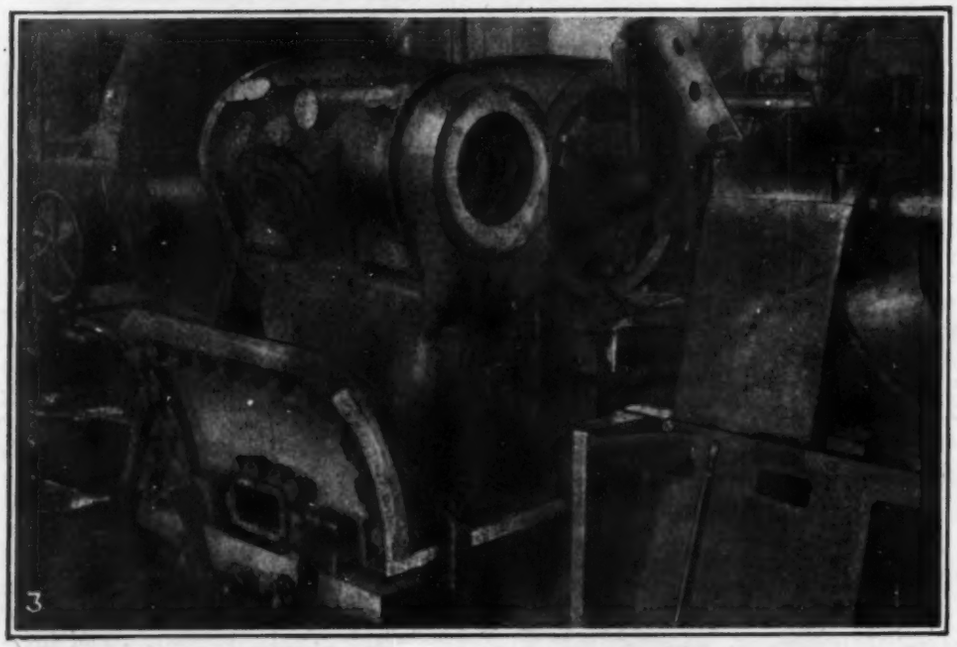
1—Rough-bore, face end and cut off
2—Rough- and finish-turn
3—Drill ports

Valve-Chamber Bushing

1—Bore and turn
2—Mill ports







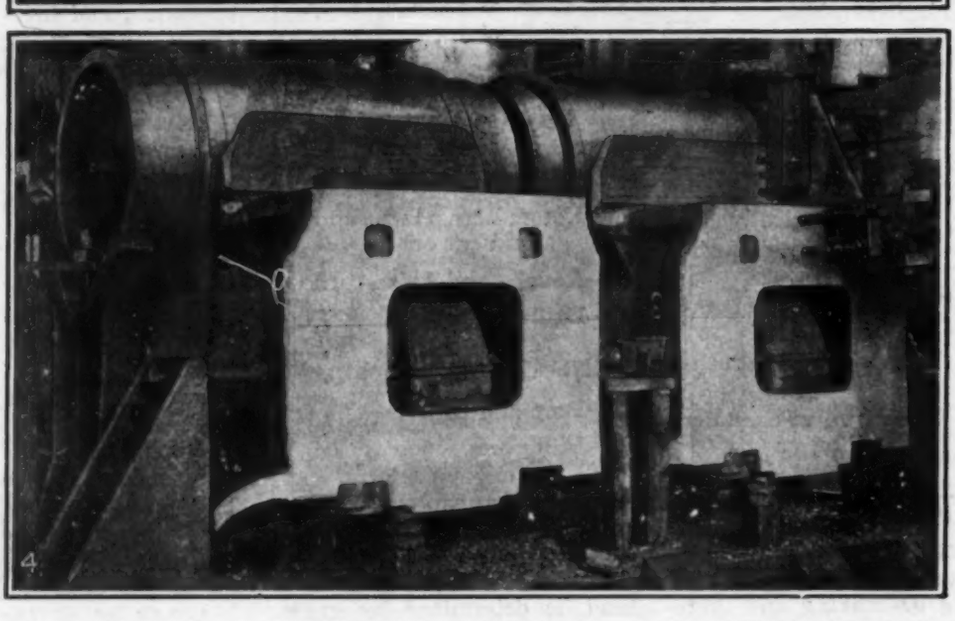


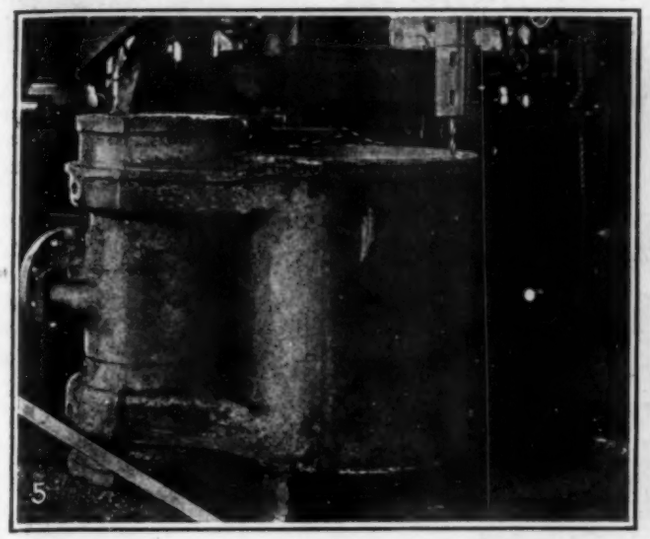
Fig. 1—Operation 1: Layout back for planing. Fig. 2—Operation 1: Layout for boring cylinder and valve chamber. Fig. 3—Operation 2: Bore and face cylinder. Fig. 4—Operation 3: Plane back and bottom

enough to secure rigidity even with the great overhang necessary. Two tools, roughing and finishing, are used in the side head. The output on this operation is approximately three cylinders per day. A Pond planer is used.

The fourth operation is that of boring the valve chamber and the set-up is practically the same as that shown in Fig. 3. There is the advantage that location is made from a planed surface. The machines used are the same kind as referred to in the description of the boring of the cylinder and the output averages three cylinders per day.

All cylinder castings are tested for leaks and it is advisable that the test be made without waste of machining. It cannot be made before the cylinder and valve-chamber are bored because they are two operations likely to uncover porous spots or blow holes. Facing is necessary to provide smooth clamping surfaces for the test heads, and holes for the head studs and for studs used in tightening other covers, as well as for pipe plugs, must be drilled and tapped.

The drilling and tapping referred to comprise the fifth operation and are done on the 6-ft. radial shown in Fig. 5. There are generally 56 holes for $\frac{7}{8}$-in. studs, 20 for $\frac{3}{4}$-in. studs, 8 for $1\frac{1}{8}$-in. bolts, 1 for a $2\frac{1}{2}$-in. pipe plug, 2 for $1\frac{1}{4}$-in. pipe plugs, and 2



for 1-in. studs. The steam pipe connection opening is chamfered also. Jigs are used in drilling all stud holes. The output is 1½ cylinders per day.

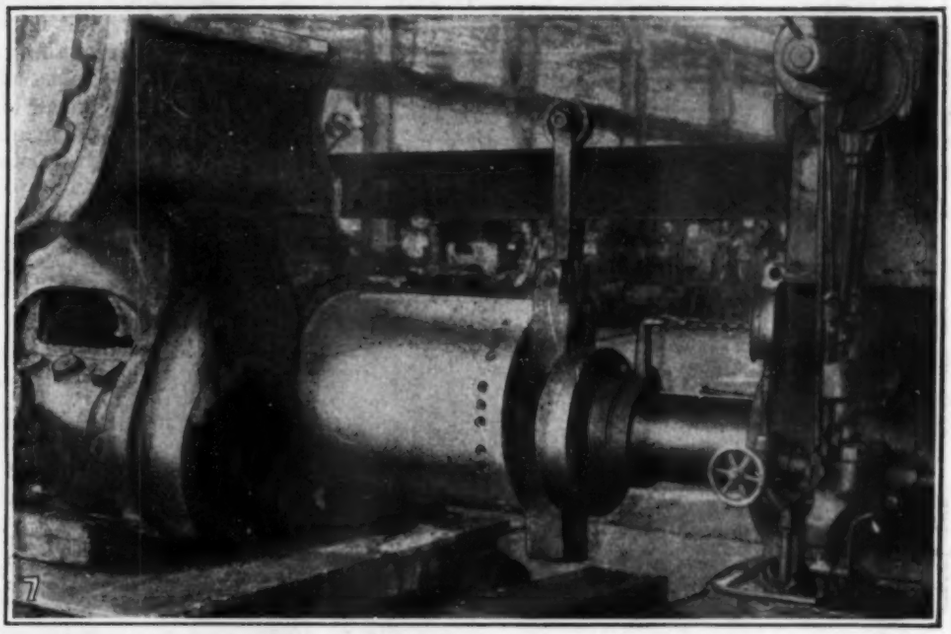
A cylinder undergoing the hydraulic test is shown in Fig. 6. The pressure which the cylinders must withstand without leaking is 250 lb. per sq.in. Applying the test heads, covers and plugs is the sixth operation and the test itself is the seventh.

After the cylinder has passed successfully the hydraulic test, the bushing is pressed in as shown in Fig. 7, the operation being the eighth. The work is done on a Putnam press with a pressure of from 25 to 60 tons, depending upon the size of the cylinder bore.

The ninth operation is that of pressing-in the valve chamber bushing, illustrated by Fig. 8. A hand pump is used and the pressure required is from 15 to 20 tons.

Reboring the cylinder bushings and reboring the valve-chamber bushings are the tenth and eleventh operations, which are practically identical, so far as machines, cutters and setups go, with the operations of boring the cylinder and valve chamber. The output is slightly greater. The operations are termed "reboring" because the bushings had received an initial boring in their preparation for the cylinder.

With the bushings completed the cylinders are sent again to the radial, for the



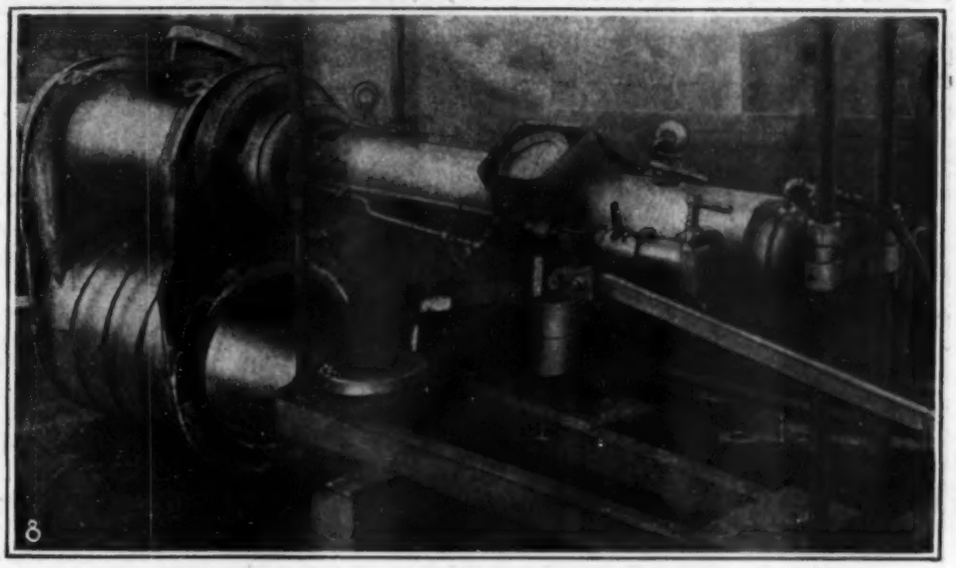
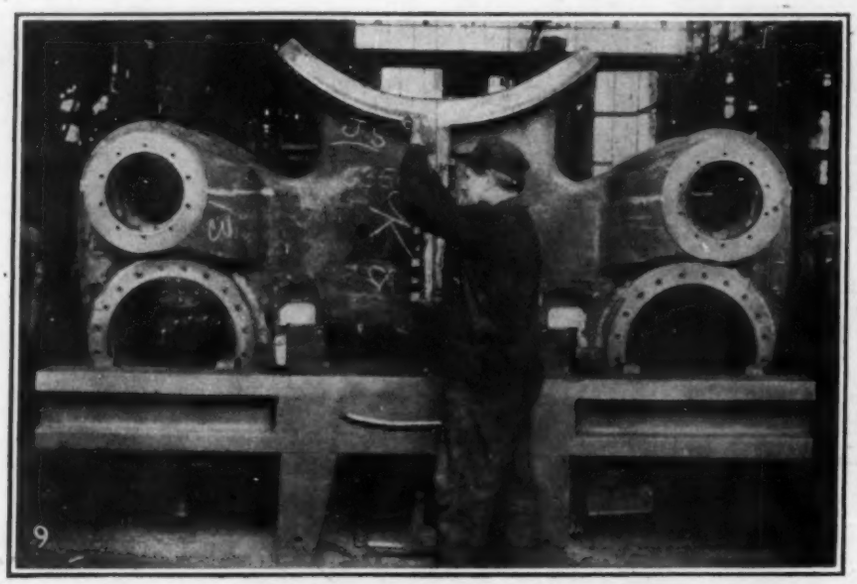
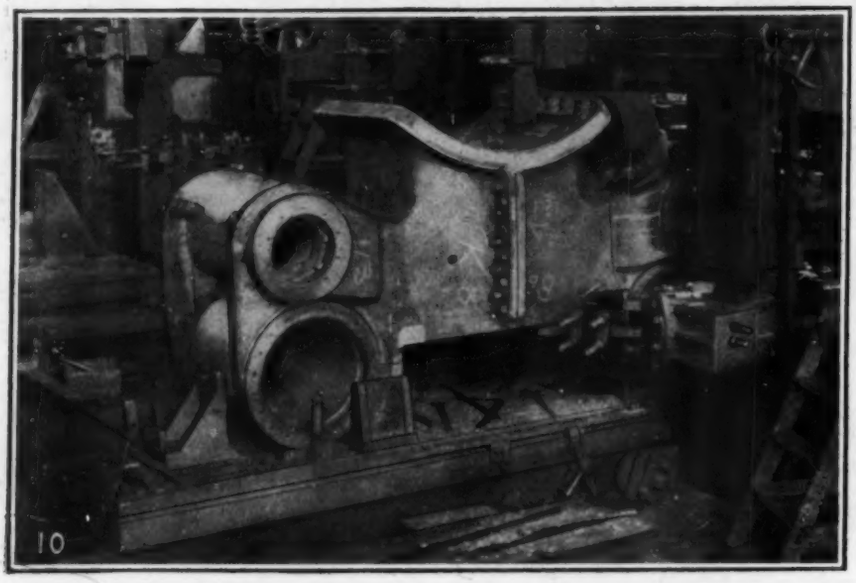


Fig. 5—Operation 5: Drill and tap for test. Fig. 6—Operation 7: Test hydraulically. Fig. 7—Operation 8: Press in cylinder bushing. Fig. 8—Operation 9: Press in valve-chamber bushing





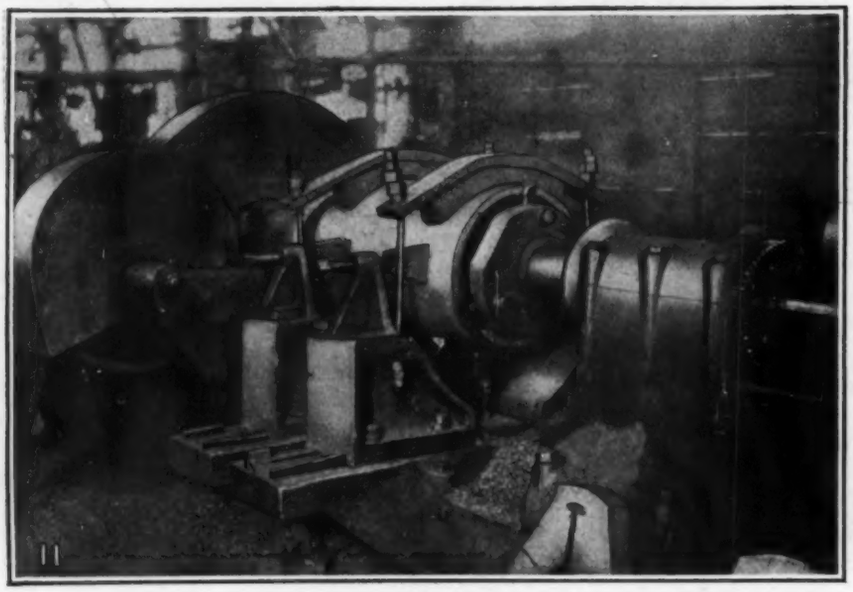


Fig. 9—Part of operation 13: Fit and assemble. Fig. 10—Operation 14: Cross plane (exhaust pipe seat and keyways). Fig. 11—Operation 1 on the cylinder bushing: Rough bore, face end and cut off

twelfth operation. The backs are drilled, using jigs, with 18 holes 1¼ in. in diameter and 6 holes 1½ in. in diameter, all 2¼ in. deep. The frame-bolt holes also are jig-drilled. There are 9 holes 1¼ in. in diameter, 2 in. deep. The output is three cylinders per day.

There are several subdivisions to the thirteenth operation, which has been listed as "Chip and clean, tap, fit and assemble." A fuller description of the first part of the operation is "Chip and clean inside and outside complete; drill casing holes; tap all pipe and casing holes." This work includes chipping the port passages, exhaust-pipe opening, steam and exhaust passages and steam-pipe collar. The work is manual.

The second part of the thirteenth operation is illustrated by Fig. 9. From the illustration it will be seen that in aligning the cylinders they are placed on a cast-iron table, being supported on parallels. They are then pulled up by clamps against four vertical parallels, two between the faces of each cylinder and an arm that forms part of the table and extends from its side. The overhanging portions of the cylinders are supported by jacks. With the cylinders clamped in position, the bolt holes are reamed and the bolts are inserted and drawn tight.

There remains one operation, the fourteenth, to be performed on the cylinders as a pair. It is the planing of the exhaust-pipe seat and keyways and is known as cross-planing. The machine is a Pond planer with side head and the cylinders are clamped as shown in Fig. 10. The output is three pairs per day.

Cylinder Bushings

Cylinder bushings are rough-bored, faced and cut off as shown in Fig. 11. The output is five per day. The casting is supported on two screw jacks and is strapped down to heavy blocks bolted to the machine table. The blocks carry four setscrews that take the front and back thrust. A cutter head carries three boring tools, one of which is replaced by a facing tool when the tailstock end is faced. The headstock end is faced by a cut-off tool and enough of the casting is removed to insure the absence of blow holes and sand spots.

Rough- and finish-turning, the second operation, are performed on a Harrington 42-in., 5-step cone-head lathe as shown in Fig. 12. Cone centers, mounted on a mandrel and pulled tight by a nut, are used and a dog on the faceplate does the driving. The output is 3½ cylinders of 38-in. length per day.

The third operation, drilling the ports, is illustrated in Fig. 13, as it is performed on a Baush radial. The sup-

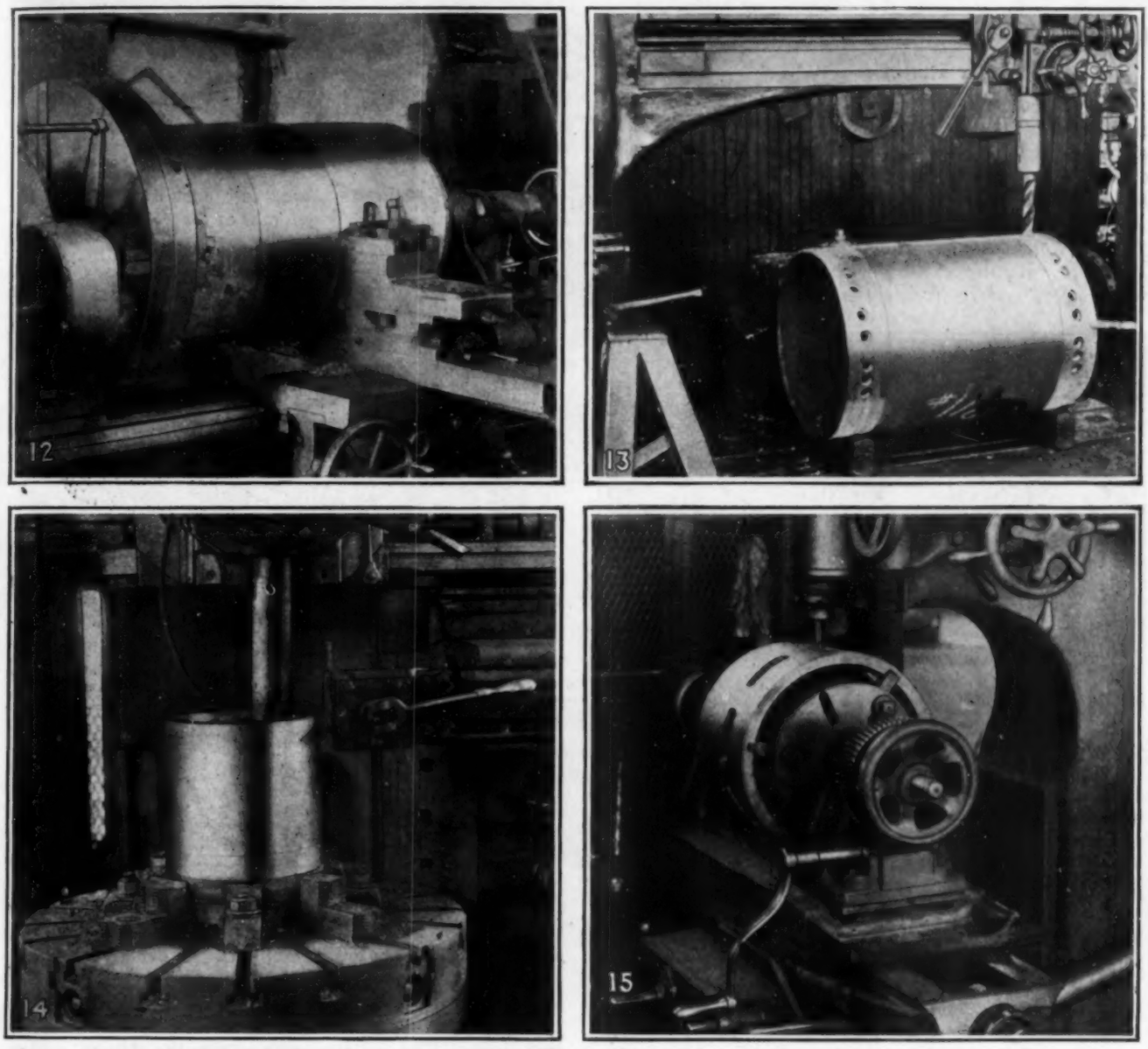


Fig. 12—Operation 2: Rough- and finish-turn. Fig. 13—Operation 3: Drill ports. Fig. 14—Operation 1 on the valve chamber bushing: Bore and turn. Fig. 15—Operation 2: Mill ports

ports are merely two blocks of wood curved to fit the cylinder bushing. The average output is 12 per day for drilling 28 holes that vary from 1¼ to 2½ in. in depth, according to the size of the bushing.

Work on the Valve-Chamber Bushing

There are two operations on the valve-chamber bushings. The first is rough-boring, turning and fitting on a Bullard vertical turret lathe, as shown in Fig. 14. The second is milling the ports on a Becker-Brainard vertical milling machine, shown in Fig. 15. The output on the first operation is six per day, of bushings with 14-in. bore. The output on the second operation is 8 bushings per day.

For milling the ports the bushing is supported on two faceplates that have means for adjustment to suit the diameter of the bore of the bushing. The stocks that carry the plates are adjustable along the table of the machine to care for varying lengths of the bushings. The faceplates are pulled toward each other by handwheels turning on the screw that connects them and serve to clamp the bushing. The feed is by means of worm and worm wheel and is operated by hand. The cutter is 1 in. in diameter and has six undercut teeth. A more complete understanding of the details of the operation will be gained by a study of the illustration.

Moisture Content and Temperature of Molding Sand

In connection with the Bureau of Standard's investigation of the properties of molding sand, the moisture of sands used in the bureau's foundry, as well as temperatures of molten metals during pouring, were recorded daily during the past month, temperature being measured by means of an optical pyrometer. The moistures determined varied from 6.89 to 7.96 per cent for Albany 00 sand, and from 8.38 to 9.94 per cent for Lumberton sand, while temperatures observed were within 1,018 and 1,170 deg. C. for bronzes and within 1,226 and 1,388 deg. C. for cast iron.

Old and New Machines Meet in this Shop

By Henry C. Francis

The shop of W. H. Chapman, Newark, N. J., is unique in several ways as the product is special machines for engraving bank notes and similar plates. While some call such machines ruling engines, they are probably better known as geometric lathes.

The engraving tool on these machines performs fearful and wonderful gyrations and can be made to trace almost any regular pattern with curves of various sizes which cross and re-cross so as to form spidery ellipses

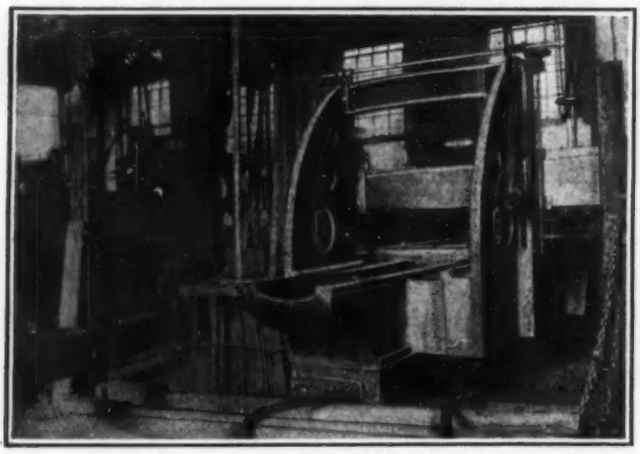


Fig. 1—Old and new planers

and fantastic filigrees. And it is all done with gearing which must be figured out accurately for each desired combination.

The work is of course special and has no trace of production methods. The shop is old, having been established by the father of the present generation. The equipment is a mixture of old and new, each doing its particular job. There is an old planer with one V- and one flat way. It was built by J. D. Cox, of Cleveland, before he went into the making of twist drills. And it is a good husky planer too, comparing favorably in weight with some of the more modern tools. Beside it is a new Gray planer, indicating the desire and intention of installing new machinery as fast as it seems necessary. The old planer, widened, is shown in Fig. 1, with the Gray in the background.

Nearby is an old shaper built by the New York Steam Engine Co., approximately 40 years ago. The base is a round column or pillar, with the ram and its driving mechanism at the top. It is still doing duty on many small parts. Just to show, however, that he appreciates modern equipment, Mr. Chapman has recently installed a Norton surface grinder to carry a wheel of 6-in. face.

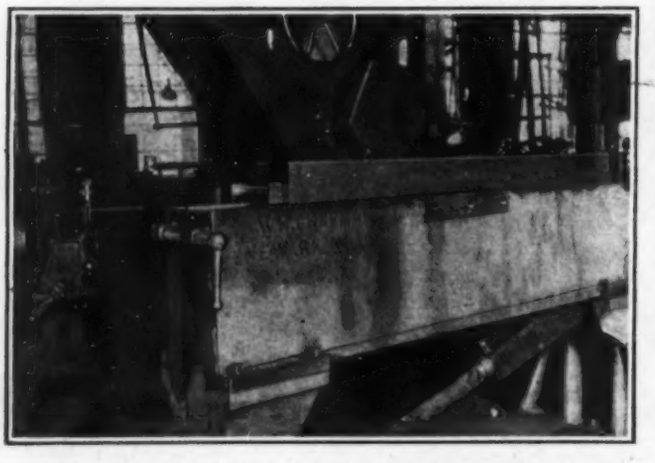


Fig. 2—Bed of one of the geometric lathes

The bed of a new machine is shown in Fig. 2. In addition to the excessive depth of bed, both bed and table have wearing surfaces of tool steel set into the cast iron. The rollers, carried in the frame which projects beneath the table, bear on the tool-steel faces.

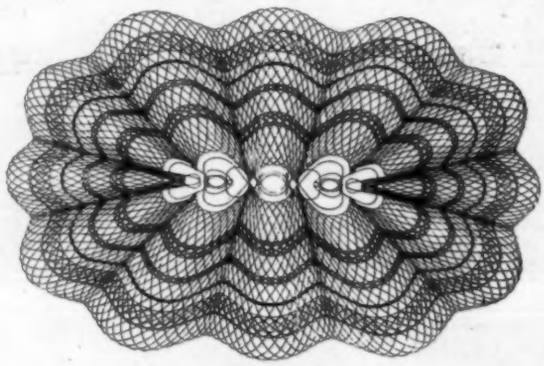


FIG. 3

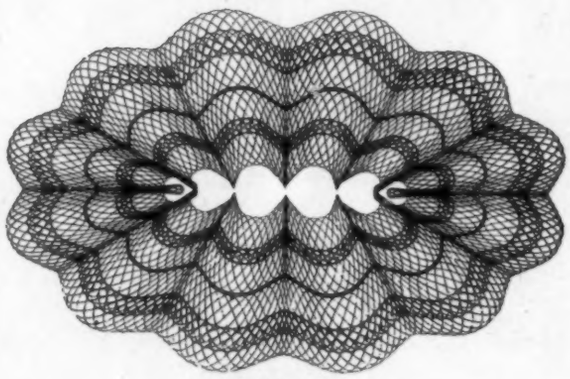


FIG. 4

Fig. 3—Sample engraving done by the geometric lathe.
Fig. 4—A slightly different design

The product of this shop goes to practically every government on earth for engraving its bank notes.

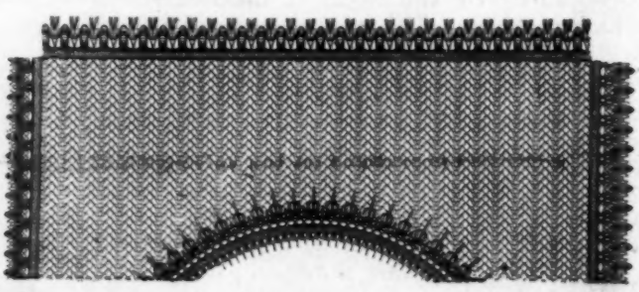


Fig. 5—Another design, corners not filled in

Some samples of the work are shown herewith. Figs. 3 and 4 were made in testing a geometric lathe. A diamond was used to cut through the coating on a plate and trace the desired pattern. Acid was then used to etch the lines. For making plates from which currency is printed, a tool is used which cuts directly into the copper plate. Fig. 5 is a sample of another type of cycloidal and epicycloidal ruling.

Utilization and Prevention of Waste

Salvaging engineering a new field — Economical disposal of waste products — Using standardization lists of simple items—Purchasing and process specifications

By C. B. Auel
Westinghouse Electric & Manufacturing Co.

THE possibilities in the prevention and the utilization of waste have not yet been generally realized by industry, though these subjects have formed the theme of many an article in the press during the past several years. Statements of course are easy to make, yet sometimes hard to prove, but in this case proof is easy, if any proof is needed, for the indictment is already on record, having been made officially by the Committee on Elimination of Waste in Industry of the Federated American Engineering Societies and published under the caption "Waste in Industry."

Manufacturers have been too prone to start with the assumption that some waste in manufacture is unavoidable, and consequently have treated the matter in a perfunctory manner, being more or less satisfied to scrutinize the items of defective design, workmanship and material, and if these appeared to be within reason to make the necessary allowances in factory overhead, and to rest content thereafter. As for so-called expense materials, even less than scrutiny is too frequently given them. This is a gross error in judgment, for improvement is almost as surely possible in waste prevention and utilization as it is in any regular line of manufacture; in fact the writer is quite of the opinion that the time is not far distant when such work will be recognized as of sufficient importance to call for a new branch of engineering talent—the salvaging engineer. In the larger manufacturing plants, this talent will probably be developed from among their own force; but, in the smaller concerns, it is not inconceivable that outside help—the consulting engineer—may be called upon for assistance.

Work of the Salvaging Engineer

The hasty assumption must not be made that this idea is far fetched, and accordingly dismissed with the brief statement that no one is so well qualified as the actual designer and builder to determine whether or not undue waste of material in design or manufacture exists. This should, of course, be so but sometimes the very reverse has proved to be the case.

Assuming, however, that it is so, there is still to be considered whether or not the best disposition is being made of the unavoidable wastes of design, workmanship and material, as well as of the wastes of expense materials, thus classed being those items which are necessary in the manufacture of any regular product, but which do not actually enter into it. And, if it be granted that these wastes might perhaps be disposed of at some other than the customary scrap value, provided systemmatic search were to be made for customers, then if customers can actually be found for one's own waste products, it would seem to be only a fair assumption that the waste products of other concerns might be used to some extent at least in one's own concern, instead of new materials.

Among the duties of the salvaging engineer, whether belonging to the regular staff of a concern or called in as a consultant, would be the study of a plant for the purposes of (1) preventing or minimizing all waste items possible; (2) reclaiming as much of the unavoidable wastes as possible; (3) disposing of wastes to the best advantage; (4) applying wastes of other manufacturers to one's own products.

Departments Dealing with Waste

For many years past, our company has paid particular attention to these matters, and no doubt a very brief description of some of our methods, as well as a statement of a few of our accomplishments, will be of interest to you.

All departments in the works naturally assist in the prevention of waste, some to a greater degree than others as would be expected; but, in what follows, attention will be concentrated principally on three, whose duties more particularly concern both the prevention and the utilization of waste. These are the Standards Division of the Engineering Department, the Standards Committee, and the Disposition Department, although another division of the Engineering Department—the Materials and Process Division—indirectly enters into this work as well.

The Standards Division of the Engineering Department, as its name in some measure implies, has to do with the standardization, within certain limits, of most production and a number of expense materials. When this work was originally taken in hand, all production items of the more commonly used kinds were tabulated from existing drawings, etc.; and, after undergoing the most careful study, were arranged in lists of what were felt to be proper and adequate sizes and kinds to cover our needs. Many off-sizes were encountered and these were omitted, while a number of new ones were included, where such were necessary to fill in gaps. These lists were then distributed to the other divisions of the Engineering, as well as the Manufacturing Departments interested, and when thus issued became standard, it being compulsory thereafter to adhere to them in the selection of materials.

Tabulations of expense materials followed in much the same manner. Our standards were not made retroactive, for it was recognized that an almost prohibitive

Abstract of paper presented at the Production meeting of the Society of Automotive Engineers, Detroit, Oct. 23.

amount of expense and time would have been involved in the changing of drawings and records, aside from which opposition would naturally have been created on all sides; furthermore, the filling of repeat orders on products built previously to the issuing of the standards, would on occasion have made it imperative to continue to use items which had not been listed. As would be expected in work of this kind, changes in these standards have been found advisable from time to time; but these have become fewer with the passing years until now standardization is largely an accomplished fact.

Unless one has actually undertaken such a task, the savings capable of being effected, especially in a large works with diversified lines of products, are hardly believable. Not only are savings possible, due to the reduced kinds and sizes of stocks carried and the simplification of records, but there is also lessened liability of dead stocks being left on hand when designs are superseded or improvements made, since parts are more nearly common to all sizes. Lower prices can moreover frequently be obtained through purchasing larger quantities of each kind, consequent upon fewer sizes.

In Table I are given several items representative of sizes and kinds deemed essential to be carried in stock

Table I—Sizes and Kinds of Materials Before and After Standardization

Item	Before	After
Steel tubing	35	20
Brass tubing	206	90
Copper tubing	78	37
Slate	336	70
Lock washers	45	39
Hammers	36	30
Files	180	30

before standardization was effected and actually found to be necessary afterwards.

To keep from retrograding, all requests for production materials must pass through the Standards Division, whose work has just been described, enroute to the Purchasing Department, so that opportunity is afforded of scrutinizing them; and, if a new item appears, inquiry is at once made of the department desiring it, to determine whether or not it is really essential to depart from already established standards.

Whenever any changes in design are contemplated, a complete study of stocks on hand or purchased, but not delivered, is made to determine when such changes can best be put into effect. This study includes machine tools, equipment and floor space, as well as the question of supply parts; in fact, endeavor is put forth to see that no point is overlooked and probable advantages are carefully weighed against possible disadvantages. Experience over a period of years has enabled us finally to develop a procedure which seems to meet our needs, as in several instances it has permitted a rather extensive series of changes to be made in a complete line of apparatus, with a write-off of but a small fraction of one per cent.

Reference has been made to the Materials and Process Engineering Department as having to do to some extent, though indirectly, with the prevention of waste, and perhaps it would be as well to touch briefly upon the work of this department before proceeding further. Our materials are purchased largely according to specifications and these are prepared by this department. In the general arrangement of such, we follow the form recommended by the American Society for Testing Materials.

When preparing a purchasing specification, advantage is taken of materials already on the market, as well as of the experience of various concerns therewith, who are frequently written to by us. The data, thus obtained, are combined with our own ideas or experience, if any, to form a preliminary specification. This specification is then submitted to suppliers of similar kinds of material and their comments and criticisms in turn obtained, such being almost invariably freely given. Thus fortified, a purchasing specification is finally prepared and issued. Suppliers are invited to submit samples, and if tests of them prove to be satisfactory, they are placed on an approved material list, to which the Purchasing Department is expected to confine itself in subsequent purchases. Revisions in these purchasing specifications are made from time to time so that, in the main, they may be said to be kept up to date.

Manufacturing Specifications

If specifications are necessary to cover the raw materials entering into one's product, their equivalent would seem to be equally necessary for the finished product and its parts, and therefore manufacturing specifications are likewise prepared by the Materials and Process Engineering Department. Consequently, we have developed a line of what we have termed process specifications, which set forth each detail of a manufacturing process, items, quantities, operations, times, degrees, finishes, sizes, etc. Like the purchasing specifications, they are revised as improvements in our products are made. The advantages of these process specifications are so obvious over any other method of supervision as almost to make comments on them unnecessary. Suffice it to say that by these means there is always a standard way of doing a thing with no change as a result of changing personnel, no repetition of earlier errors or use of less accurate methods and therefore there is a minimum of defective work from these causes.

The Standards Committee is the second of the three main departments having to do with waste and waste prevention. Its work parallels in a manner that of the Standards Division, except that the items handled by it are usually more complex. The make-up of this Committee is rather unique, consisting as it does of but two permanent members, the chairman and the secretary. These two are constantly on the look-out for new subjects suitable for consideration as standard, and when such are found, a sub-committee is appointed, with its chairman, and instructions are issued on the work to be done. In order to facilitate matters, a representative of the Standards Division sits in on each sub-committee so that, when data are needed, this representative can arrange for procuring it with the minimum of delay. From six to ten of these sub-committees are always at work. Their chairmen form the other members of the Standards Committee. When any sub-committee is ready to make a report, a meeting is called by the permanent chairman, of the chairmen of all of the outstanding sub-committees to consider it. When a report is accepted by this main committee of chairmen and further approved by the management, the sub-committee, making the report, is then dissolved. The members of these sub-committees do not permit

their regular duties to be neglected, and for this reason the reports sometimes require a greater length of time to complete than they otherwise would, but, aside from this, we have found no draw-backs to this scheme.

The subjects considered by these sub-committees are very diversified, although not intruding in the field of design to any larger extent than does the Standards Division. Aside from standardizing certain production and expense materials and methods, attention is also given at times to small tools and to shop and office equipment. A glance at Table II will indicate how wide a range is really covered.

Table II—Range Covered by Sub-Committees of Standards Committee

Punched circular washers	Keys
Tap drills	Punched nuts vs. machined nuts
Eye bolts—Allowable stresses	Spot welding
Bearing babbitt	Springs—Reduction of sizes
Furniture standards	Hammers
Handle grips	Tubing—Brass and copper
Ferrules	Springs—Material
Thumb and wing nuts	Slot files—Machinists'
Storeroom fixtures	Cleats
Anchor holes in bearings	Oil rings
Marble, slate and soapstone bases	Welding—Illustrations and definitions
Trucks, barrels and wheel tote boxes	Bed plate design and method of lifting
Counterbores and facing tools	Passes for employees
Pulley sizes	Crane chains and slings
Anchor plates and foundation bolts	Bearing allowances
Rigid couplings	National screw threads
Finish allowances on bolts and nuts	Protective treatment for materials to be soldered
Steels for tool room use	Paper forms
Shaft allowances for pulley fits	Lumber
	Belting
	Fibre and paper containers
	Storing employees' clothing

The Disposition Department, which is the third of the three main departments, mentioned as having to do with waste and waste prevention, embraces more than the salvaging of waste materials, for it endeavors to reduce or to eliminate waste of all kinds as well. It will be seen, therefore, that its staff must of necessity be thoroughly familiar with its own works, including the materials used, methods of manufacture, products, personnel; and, at the same time, have a wide knowledge of the uses to which materials may be put that appear as waste in their own plant. If this knowledge is supplemented by a familiarity with the methods of other plants, such knowledge will on occasion prove of value as enabling waste material to be purchased and substituted for good raw material.

The Disposition Department gives the larger share of its attention to inactive stocks, raw, semi-finished and finished, which are regularly reviewed, the idea in this being to endeavor to prevent their becoming obsolete. This is accomplished in various ways, advantage being taken of any existing channels, which seem to offer opportunities for disposal, though the department is empowered, if necessary, to create new ones.

All inactive stocks, and this embraces not only those showing no movement but those showing insufficient movement over a given period, are listed and at the same time depreciated and passed on to the Disposition Department for any treatment which will tend to put them back into the active class or at least prevent the necessity for more drastic action. If, at the end of a year, the Disposition Department has been unable to effect results, the stocks are further depreciated, the Disposition Department meanwhile continuing its efforts to move them. If, at the end of a further year, they are still inactive, they are transferred to the obsolete class, are more heavily depreciated and within the following six months, failing movement, must be disposed of.

In the disposition of inactive materials, endeavor is first made to apply them "at home," for, in this way, the loss is likely to be least. If not possible to apply "as is," some simple modification may be all that is necessary, like the redrawing of a copper strap to permit its use. Or the Engineering Department may be called upon for help and permission obtained to substitute one material for another, say where cross-section continues unaltered but dimensions differ.

Failing application at home, all surplus raw materials, hardware, cutting tools and pipe fittings are bulletined and distributed to our various works as well as to commission agents at reduced prices.

"Clean-Up" Inventories

Work-in-progress also comes under the scrutiny of the Disposition Department through the medium of quarterly "clean-up" inventories, at which time any "held" orders pass in review. All such orders must be lifted out of work-in-progress account and placed elsewhere, as it is not considered either good business or fair to those in charge of manufacture to make the account bear a burden of this kind.

During the quarterly "clean-up," inspections are made of all employees' cupboards and drawers and any tools in excess of a normal supply are returned to the tool rooms, thus keeping small tool investment within bounds.

The Disposition Department does not confine its activities to the preceding functions; for, if their investigations in salvaging lead them to believe waste may be prevented anywhere, they do not hesitate to follow such a matter back to its source, including stock control. The field of this department, however, does not include the work of inspection, such as the examination of raw and semi-finished materials coming into the works, or of the regular product in course of manufacture, or even the disposition of routine scrap, such as turnings, borings, filings, etc., all of which can be handled by the Inspection Department. Within the functions of this department, however, are the general inspection of all departments and yards for the purpose of seeing whether or not such regulations for the avoidance of waste, as may have been established, are being observed; or where the department does not have charge, the work is specifically delegated to some other department.

These inspections are more important than would seem at first glance, and should hardly be passed by without a few words of additional explanation. Aside from the more evident, yet often overlooked, items to be on the watch for, such as electric lights or gas fires left burning needlessly, leaking water or steam pipes or air hose, motors allowed to run unnecessarily and so on, there are numerous other items not so apparent, but equally important as far as waste is concerned, and careful attention to which will result in wastes being avoided. Among these may be mentioned: motors too large or too small for the work due to rearrangement in shop tools, high priced oils for cutting and machine tool lubricants where low priced oils would answer,

turpentine for thinning paint instead of cheaper substitutes, mixing of metal wastes instead of keeping them separate, solid high-speed steel tools instead of tools with high-speed steel nose and carbon-steel shank, cotton waste for near-white wiping rags, checking of gages and meters, and so on.

Checks are made at intervals on the power supply both for voltage and speed, as a moderate drop in voltage, say 10 per cent, will lower the factory illumination by 30 per cent, while any reduction in speed of the generators (if alternating current, as is generally the case) will correspondingly affect the speed of the driving motors throughout the factory.

Storing, Boxing and Shipping

Considerable could be said on the subject of storing, boxing and shipping of stocks, as these items should not be omitted in a study of waste prevention. While handicapped at times for space, we endeavor nevertheless to observe certain precautions, which experience has taught us. Boxed material is fully marked on the outside so as to be readily identified, and this marking is given a coat of shellac to keep it from being obliterated. Materials in fiber or paper containers are raised several inches from the floor to avoid the effects of moisture, and many of our readily oxidizable items are given a protective coating, while much of our cast iron is paint-dipped before shipment from the foundries. Sufficient space is allowed between aisles and all piles are reversed at intervals to avoid retaining the older stock. Sheet material, like oiled duck, is never piled in layers of over 1 in. without the use of separating pieces of wood, to reduce the risk of spontaneous combustion. Oily waste is always stored in metal containers. Bar stock is frequently piled vertically to conserve space and is painted either across the ends or by a full length stripe to permit of one kind being distinguished from another. Sheet steel material is similarly painted.

A scrap department has, of course, been installed, fitted with all the necessary appliances which go to make a complete outfit of its kind.

Scrap is first sent there to be inspected and classified before its further distribution. Every consignment to that department must have full information accompanying it so that, if necessary, the department forwarding may be communicated with and called to task if procedure has been violated. There is one class of scrap, however, that does not reach the scrap department and that is bulk iron and steel filings, turnings, and borings in the heavy machining departments, which accumulate so rapidly that they are placed in large containers and unloaded by cranes every day or so on to freight cars which are taken directly into the departments.

A number of years ago a careful study was made of our various kinds of non-ferrous scrap, the quantities of each, the value received by their sale, the cost of reclaiming, etc., with the result that a reduction plant was installed. We now do not only the reclaiming of almost all of our non-ferrous metals but buy from our subsidiary plants and affiliated interests as well.

Since we use drawn copper in very large quantities, it was but logical that we should also install a copper mill, where much of our reclaimed pig copper is drawn out into bar and strap stock. This mill has also largely eliminated inactive sizes of copper bars and to a less extent wire.

Sawdust, mixed with soda, is used as a fire-extinguisher for oil fires. It is also used for drying purposes in our plating department as well as for packing and this last is true to some extent with shavings.

Waste paper is largely sorted, baled and sold, although it may be shredded and used for packing purposes.

Soiled wiping rags, formerly reclaimed by us, are now sent by one of our plants to a laundry, washed and paid for at so much per pound for rags returned; if reclaimed by one's self, care should be taken to avoid fires, and it was this feature which compelled us to abandon our own reclaiming of them.

Used sugar bags serve admirably as fine wiping cloths, being superior to cheese cloth or canton flannel and cheaper.

Scrap sheet iron of the thinner sizes is baled by machine, and sold, a higher price being thus obtained than otherwise.

Oily or worn belting is reclaimed by immersion in gasoline and then made over into belting again or into hand leathers, washers, etc., the smallest pieces being sold to manufacturers of boot heels, carbonizing materials, etc. One of our plants prefers to send its belting to a concern which will reclaim as much of it as possible, selling it back at a heavy discount off list price.

Used files are purchased from junk dealers. They can usually be resharpened twice and then recut. Tests show that they give results equal to, in many cases superior to new files, and at considerably reduced cost.

Cutting tools, if of high-speed steel, when too short for further use are drawn out to the next smaller size.

Empty carbide cans are mounted on feet and used for waste containers.

Welding is employed regularly both on production and on repairs, and where defects can be corrected on material on which labor has been performed and which would otherwise be a loss, the saving is at times considerable.

When one of our works had a steel foundry connected with it, the electric arc was largely used to cut off sink heads and risers.

Cutting oils are reclaimed.

Nuts, bolts, screws, rivets, and washers become mixed from various causes and are regularly resorted.

Large magnifying glasses on milling machines engaged in certain small work have eliminated all defectives.

Other Miscellaneous Savings

Inter-departmental envelopes are ruled across the front and left unsealed, thus permitting them to be used several times before being finally discarded.

Short lengths of copper wire and strap, steel and iron, paper and bar, are electrically welded.

Nickel anodes and other material, such as angle or channel iron are welded with the oxy-acetylene torch. An automatic cut-off valve is used, which shuts off the gas, leaving but a pilot light burning.

Hydrogen welding is employed for reclaiming lead battery lugs and the like.

And so the list of savings might be continued to considerable length, especially if there were to be included items of less general interest and having to do more particularly with our own industry; for example, such items as the patching of slate or the making of copper-tube connectors from the ends of mill-length tubing, etc. It is believed, however, that enough has been shown to demonstrate to you, if any demonstration were needed in an audience such as this, that the reclamation and prevention of waste are like electricity, as yet in their infancy.

Automotive Production

Coining-Press Methods for Automobile Parts

By A. R. Kelso
Master Mechanic, Hudson Motor Car Co.

A method that eliminates many machining operations, secures uniformity of production, improves the quality of the steel and increases production to an astonishing degree

THE coining press is a machine capable of exerting tremendous pressure and was originally used for embossing coins. The machine was invented in 1833 by M. Thonnelier of France and, in 1836, one was included in the original installation of equipment for the first United States Mint.

The first coining press, having the conventional knuckle action, was the forerunner of the present machine for commercial work. Further developments placed the toggles underneath but this design became impractical when larger machines were built, because the increased distance from the floor to the dies made deep pits necessary for convenience in operation and the previous construction was used. An advantage of the knuckle movement is the increased pressure exerted at the end of the downward stroke. The position of the ram at the end of the stroke is controlled by a screw actuated wedge, as illustrated by Fig. 2 which shows the ram in both the up and down positions. The modern machine has been renamed the "squeezing press," due to its varied adaptability to all classes of work within its range.

Increased production schedules made equipment for milling or spot-facing forged arms and levers inadequate, being particularly manifested in brake and equalizer mechanisms. A change of method was proposed and data relating to coin-press methods were secured. Some of the heat-treated forgings, made from S.A.E. 1045 steel, having a Brinell hardness of 197, were tested under an Olsen universal testing machine. This test determined that an average pressure of 163,000 lb. per sq.in. of area was necessary to compress the part to the desired dimension. Other forgings of S.A.E. 1025 steel, having an average Brinell hardness of 137, required a pressure of 100,000 lb. per sq.in. of area. These figures give an idea of the tremendous force necessary to coin-press parts where the affected area is considerable.

It was concluded that one press could easily squeeze all of the parts to size and release the various machines on hand for other work. The largest part on which a squeezing operation was necessary had

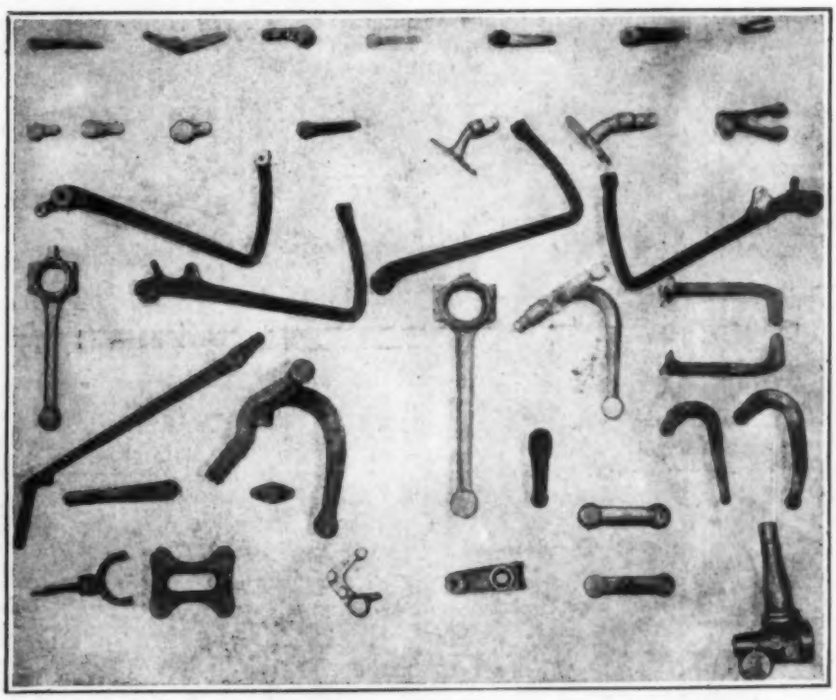


Fig. 1—Parts of Hudson and Essex Cars now coined

Abstract from paper presented at Society of Automotive Engineers Production Meeting, Detroit, Oct. 22 to 24, 1924.

AUTOMOTIVE PRODUCTION

an area of 2⅞ sq.in. A 400-ton coining press was installed. It was found advisable to reduce the finish allowance on each surface from 1/16 to 1/32 in. The parts shown in Fig. 1 are now being coined. With parts having two or more bosses of different thicknesses, steps were arranged on the dies as in Fig. 3 whereby

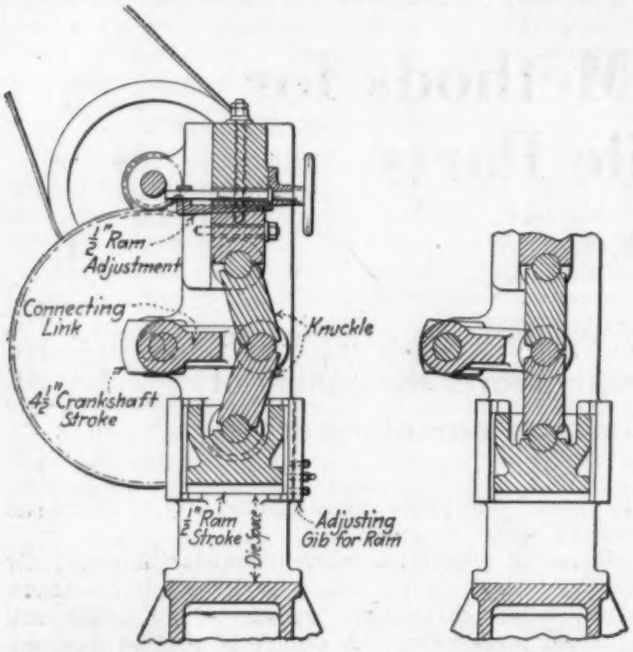


Fig. 2—Diagram of press and its adjustment

all of the bosses could be squeezed at one cycle of the press. It had formerly been necessary to perform a separate operation for each boss, while with the new method but one operation was necessary. Very close limits were maintained, being made possible by the accuracy of the ram adjustment. Based on an efficiency of 75 per cent, a production thirteen times greater than by the machining method was acquired. The result was that one man and one machine replaced twelve machines and as many operators.

To determine the most suitable die materials, several sets of dies were made of different grades of cold-forging die steel. The average run from the standard brands was 6,000 pieces before it became necessary to resurface them for either or both of the two following causes: Fracturing of the working surfaces due to extreme pressure to which they had been subjected, or, an impression of the part in the die at the point where pressure had been applied.

To correct the difficulty a special steel of the following analysis was made:

Silicon	0.05
Manganese	0.20-0.30
Carbon	0.67-0.80
Chromium	0.09
Vanadium	Trace
Sulphur	0.021
Phosphorus	0.010

With steel of this composition, heat-treated to a scleroscopic hardness of 90, the average output of the die rose to 40,000 pieces before resurfacing was necessary.

Experiments with the first group of parts showed savings so great that the equipment could be amortized in less than one year. After determining the requirements, three more 400-ton presses were purchased. These machines pressed all of the parts shown in Fig. 1 excepting the connecting rods. The following shows the percentage of increase in hourly production, by using the squeezing or coining process:

Part Name	Percentage Increase
Brake lever—single	1,043
Equalizer shaft—arm	960
Brake lever—double	780
Internal-brake lever	928
Pedal	480

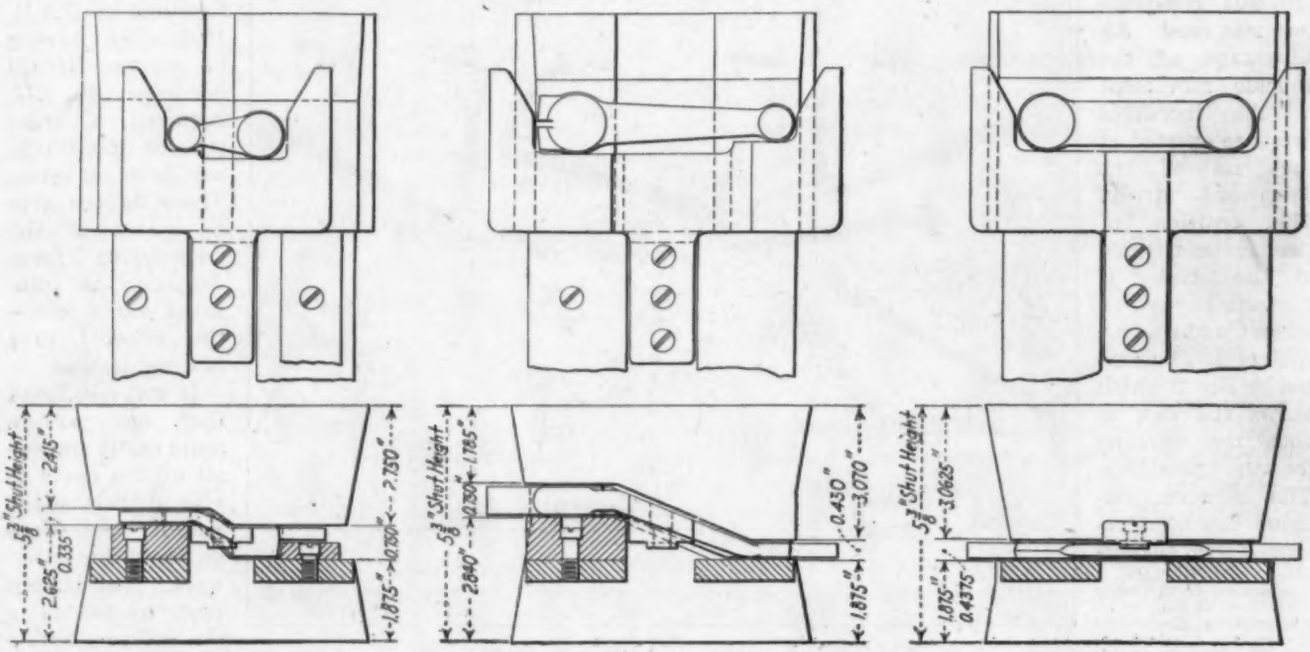
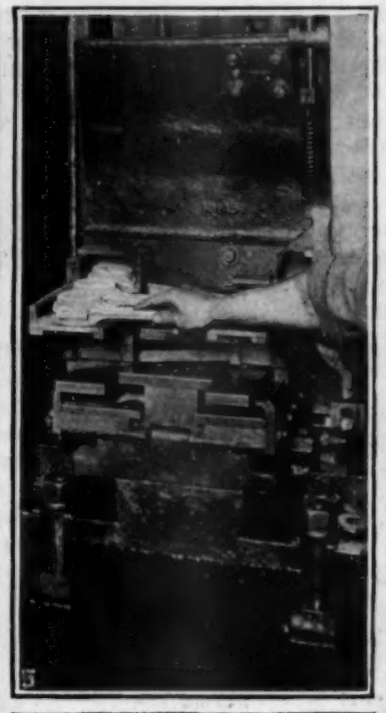
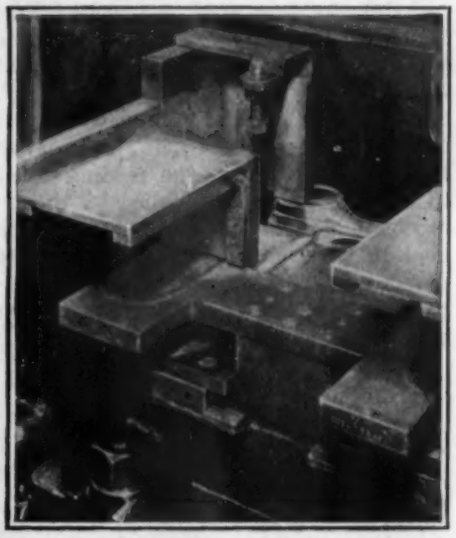
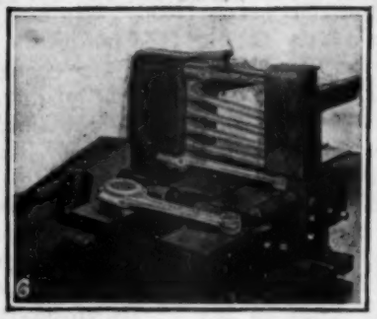


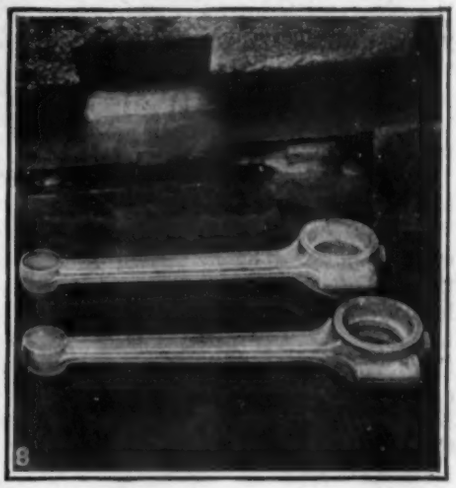
Fig. 3—Details of dies

AUTOMOTIVE PRODUCTION









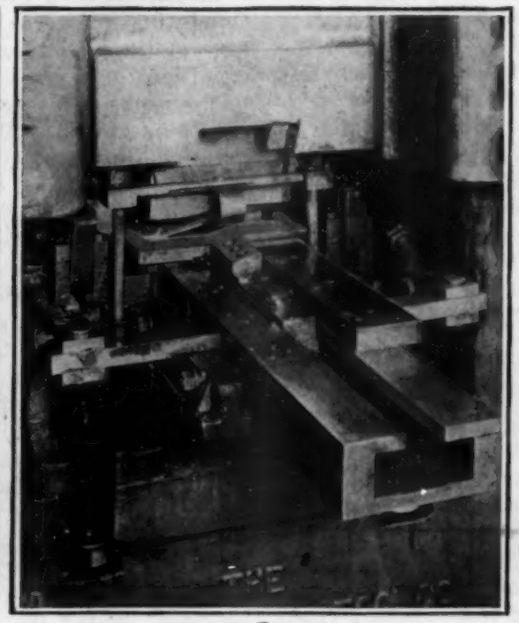


Fig. 4—The coining press—hand feed. Fig. 5—Loading the magazine feed. Fig. 6—Details of magazine feed. Fig. 7—Connecting rod in die. Fig. 8—Rods leaving press—inserts in dies prevent kinking. Fig. 9—Another feed mechanism. Fig. 10—Piece in place—note drag spring. Fig. 11—Work coming out back of press

AUTOMOTIVE PRODUCTION

After the four 400-ton machines had been in operation with satisfactory results, it was decided to squeeze the connecting rods. Since the largest connecting rod had a total area of 3⅛ in. of metal to be displaced, an 800-ton press as shown in Fig. 4 was selected. It increased the production 251 per cent with one operator, hand feeding. After the feeding mechanism as shown in Fig. 5, had been installed on the press to eliminate any possible chance of injury to the operator, the production was again increased 147 per cent. This final result was 370 per cent greater than milling and the product continued to be held to the 0.004-in. tolerance specified.

Feeding Mechanisms

The feeding mechanism mentioned was attached to the front of the bolster plate and is shown in Fig. 6. It consists of a channel in which the rods are stacked and a reciprocating slide to feed a forging on to the die at each stroke of the ram. When the stock had been fed by hand only one stroke of a possible five was utilized. With the incorporation of the magazine, the press was in continuous operation and a piece was pressed at each cycle. Fig. 7 shows a forging in position ready to be squeezed. In Fig. 8 the rear of the machine is seen.

The magazine for feeding the connecting rods proved satisfactory as both a production and a safety factor. Therefore, feeding mechanism was designed to take care of all the parts shown in Fig. 1, except those that required holding in position while squeezing at a local point. With this arrangement the work is fed to the die by a slide equipped with detachable fingers, the fingers being designed to meet the requirements of the individual part. To insure the greatest safety for the operator and keep him at a safe distance from the ram, a pull-type feed with a 12-in. stroke was installed. The driving member was attached to the rear of the ram and operated the slide through a crank movement fitted between the sides of the die and the housings of the machine. The front was thus left clear except for the feed slide. To guard against stock jamming, a safety spring was incorporated in the driving member. At the recommended speed of the press, 32 cycles per min., the speed of the feeding device was so great that inertia forced many pieces through beyond the die. The work was therefore made to pass under a flat spring acting as a drag, as shown in Fig. 10. This permitted handling the smallest parts with the press running continuously at the desired speed.

Action of the Drag Spring

Figs. 9, 10 and 11 are views of a machine on which the drag device was used. In Fig. 9 the operator is loading work with the slide in the back position while the dies are squeezing the piece previously fed. The drag spring in front of the upper die can be seen holding one of the pieces. Fig. 10 shows the position of the side when inserting stock, while Fig. 11 shows the work coming through at the rear of the machine.

The following is a comparison of the increases made by both the manual and mechanical feeds over the machining methods formerly used.

From these various examples shown it is easy to see the large savings that may be effected by this method. Not only is the time required for coining much less than for milling but the handling time is decidedly less than where milling fixtures are used. Then too the problems of chips and coolants are eliminated.

	Percentage Increase over Machining Method	
Part Name	Manual Feed	Mechanical Feed
Accelerator lever	387	583
Accelerator lever	430	537
Brake lever	1,042	1,864
Brake lever	780	944
Clutch yoke	358	894
Fan supporting-arm	624	774

Believing that it would be of general interest to know what happens to the grain structure when a forging is coin-pressed, an investigation was made to determine what changes take place. For this purpose a connecting rod, made from S.A.E. 1045 steel was chosen. Before coin-pressing, it was warm-water quenched from 1,475 deg. F. and then drawn to 2,200 deg. F. This produced a Brinell hardness of from 187 to 217.

Change Not Noticeable

Several sections across coin-pressed areas were examined. It was impossible to note the distortion of the grain at 100 diameters magnification. Because of the fine grain structure of the heat-treated connecting rod, any change that had taken place would have been difficult of discernment. Several rods were then heated to a high temperature for a long time and allowed to cool slowly, causing the grains to grow large and to separate into the various constituents. Some of these rods were coin-pressed and sections examined but no change was noticeable. This would seem to indicate that compresson of the section is a uniform distribution throughout the total volume compressed.

To substantiate this conclusion, one of the annealed connecting rods was coin-pressed across one-half the area of the piston-pin boss. This gave three different conditions on a cross section through the boss. Photomicrographs at a magnification of 100 diameters, showing the sections at the surface before and after compression indicated that the grain structures were identical and showed conclusively that the coin-pressing operation did not affect the material adjacent to the surface. The compression was uniform throughout the entire volume of the part coin-pressed.

In view of the results secured by a careful and thorough application of the coining method to the work shown, there seems to be no reason why this method should not be extended to other lines of work as well as to other automotive parts. The saving in metal alone, over that required where parts are machined in the regular way, becomes an appreciable item.

Our experience shows that: A coining press will squeeze parts to size with the same degree of accuracy as is accomplished by the removal of surplus stock through cutting operations; there is no difference in the molecular constituency of the parts after they are squeezed; with quantity production, the average number of parts prepared by a coining press is 900 per cent greater per hour as compared with usual machining methods.

Spur Gear Speed Reducers

What Are They? Why and Where Are They Used?

By Warren G. Jones
W. A. Jones Foundry and Machine Co.

Range of reduction ratios—Straight-line and offset drives—Origin of the enclosed reducer—Advantages in space economies—Comparative cost and upkeep

I BELIEVE that the various manufacturers of spur gear speed reducers will agree with me when I say that even at this time a surprisingly large number of engineers have but a faint idea of what spur gear speed reducers are and the reason for their growing popularity.

Spur gear speed reducers are totally enclosed spur gear drives designed to decrease or step down speeds between electric motors and comparativly slow moving machines. In application they are interposed between the motor and the driven unit. A flexible coupling connects the motor shaft to the high speed reducer shaft, which is thus driven directly at the motor speed of revolution. Another flexible coupling connects the low speed shaft of the reducer to the shaft of the driven machine, causing rotation at a relatively low speed as the requirements dictate. The final speed of the driven machine is governed by the revolutions per minute of the motor, and by the reduction ratio accomplished by the reducer.

The reducers are most generally made in reduction ratios ranging from 4 to 1 up to 200 to 1, although there are many cases in which smaller or larger ratios are required.

Spur gear reducers consist essentially of one or more trains of spur gears assembled in a housing, with provision for oil bath lubrication. They are manufactured in a wide range of standard sizes, horsepower capacities and ratios, to meet nearly all ordinary conditions of service. The ratio of reduction when once selected is constant, so in this connection they should not be confused with a change-speed box or variable speed transmission.

The Two Types of Reducers

Speed reducers of the description given fall into two general types so far as internal design is concerned. One is where the high and low speed ends are concentric, thus making a straight line drive. In the other the high and low speed shafts are not concentric, giving an offset drive. Each style has certain advantages not possessed by the other, while there are many general advantages that are common to both. As an example, space conservation in one instance might call for the concentric type, while different installation conditions might find the offset type more suitable as a space saver.

Offset reducers are designed with one or more trains of spur gears assembled in a cast-iron housing split horizontally on the center line of the shafts, which are all in the same horizontal plane. The gear assembly is somewhat similar in arrangement to an ordinary open spur gear drive.

Inasmuch as each pinion and gear is required to carry the full load at the point of contact, the pitch diameter and face of the gears must be proportioned with this in mind. That is, the gears must be larger and the pitch line velocity greater than if the load is distributed between two or more sets of gears. The reducer with a housing split horizontally is simple in construction and has special advantages where installation arrangements call for an offset drive to save space.

Straight-Line Drive

The straight line or concentric drive is entirely different. It consists of one or more trains of spur gears having several points of contact. A central driving pinion is surrounded by two, three or more gears equally spaced, the central pinion driving each of the surrounding gears, thus providing separate points of contact for each train.

The assembly is made in a cast-iron housing of circular section with removable heads. The high and low speed ends are concentric, and have the same direction of rotation. Due to the total load being distributed among several points of contact, the gears may be designed with a finer pitch, with small pitch diameters and consequently with lower peripheral velocities, than when single point contact is used.

These advantages are further emphasized by the fact that small gears also better lend themselves to accuracy, and in manufacturing can be held commercially to closer limits.

So much for what spur gear speed reducers are. The question of "Why are they used?" takes us back to their history.

Spur gear speed reducers of the types under discussion have been manufactured for about twenty years and probably owe their early popularity if not their actual existence to the cement industry. The atmospheric conditions in cement mills are such that exposed or open gear drives quickly deteriorate due to the destructive action of the cement dust. It became evident that there was a real need for adopting the economy of the electric motor drive and at the same time protecting the power transmitting factors from

Paper read before the American Gear Manufacturers' Association, Oct. 16, 1924.

the abrasive action of the atmosphere laden with dust.

The enclosed speed reducer was the result of research along these lines. It quickly proved its value. The cement industry adopted this new development in ever increasing numbers.

It was only natural that other industries should hear about this new method, if I may call it that, and become interested.

The advantages of the enclosed speed reducer apply to other industries even though atmospheric conditions are not as serious as in the cement field. Any one of these advantages might be a deciding factor in the decision to install enclosed speed reducers. Conditions vary in different plants, but the need for economical, efficient transmission of power is common to all. In this respect the enclosed speed reducer is a very conscientious performer.

Economy of space in many instances is also an important consideration. The safety feature, due to its enclosed construction, reduces the accident hazard. And the fact that the gears are running in an oil bath, under dustproof conditions, insures positive lubrication at all times with a minimum of attention.

Self-Lubrication Essential

This self lubrication feature has proved particularly important in obtaining acceptance for the enclosed reducer idea. Engineers have always appreciated the necessity for proper lubrication of working machinery in keeping up the efficiency of a plant, in cutting down repairs and replacements, in saving power and keeping down costs. The bill that faulty lubrication places on the auditor's desk of American industry is a large one. According to a prominent oil manufacturer, the editor of a well-known machinery publication estimates incorrect lubrication to be the cause of 70 per cent of all repairs to plant machinery. Some plant executives put the percentage as high as 80 per cent or even 90 per cent.

It has also been estimated that at least 80 per cent of automobile ills can be traced to carelessness in this respect. And while the percentage is probably smaller in industrial plants, because of closer attention, more frequent inspection and more expert supervision, the problem is a real one.

The condition exists, and the totally enclosed speed reducer running in a continual bath of oil reduces depreciation and upkeep expenses to the minimum in the important department of reducing speeds in power transmission practice.

Advantages of Reducers

Since reducers with motors do away to a large extent with pulleys and belts and other space consuming devices, they do not interfere with the diffusion of light, thus helping to make the factory more attractive.

The question of initial cost is of course an important factor in almost any sale. Although the cost of installing speed reducers varies, it can be said that they are not more expensive than other methods of obtaining reduced speeds when the jobs as installed and ready for operation are compared.

It is true that the cost of various units such as gears, belts, ropes and shafting, may be lower, but the cost of laying out, assembling, installing and adjusting these various units must be considered.

Then the upkeep angle presents itself and the enclosed reducer has a big cost advantage there, as a moment's reflection will demonstrate. As the motor and reducer are mounted on a single base and connected to the final drive by a flexible coupling, alignment and bearing troubles are done away with from the start.

To state specifically where they are used would be a very lengthy task. It is sufficient to say that they have been adopted to varying degrees by almost all industries where high speed electric motors furnish the power for driving slower moving machines.

A few of the more common applications are elevators, conveyors, feeders, agitators, mixers, cookers, screens, stokers, tables, fans, dryers, crushers, car hauls, pumps, hoists and gas producers.

Taken as a whole, the spur gear speed reducer is a highly specialized and technical development of gear manufacture and application, requiring individualized manufacturing facilities and engineering knowledge. Only time can tell the extent to which reducers may render a broadening service to industry's need for power transmission devices.

Famous Machinists of History

By H. H. Manchester

Sir William Fairbairn (1789-1874)

Sir William Fairbairn was born in 1789, at Kelso, Scotland. His father was a bailiff in poor circumstances, and when 14, William was set to work at three shillings a week as a mason's helper on a bridge then being built by John Rennie in the town. A few days later, however, he suffered an accident and had to stop work. Later that year he was a carter for a colliery, but in 1804 was finally bound as an apprentice to a millwright at Percy Main. This gave him a chance to learn how to handle both woodworking and metal-working tools.

During these years he began a course of systematic study to make up for his lack of education, and met George Stephenson, who later invented the first commercially successful locomotive.

After his seven years apprenticeship, he roved as a journeyman millwright and machinist over Scotland and England for about six years. Then, in 1817, together with a shop-mate by the name of Lillie, he set up a lathe in an old shed in Manchester and began business for himself.

The firm soon gained a reputation for improvements in mill-gearing and water-wheels, and the partnership lasted fifteen years.

About 1832 Fairbairn became interested in the use of iron for boats, and was a pioneer in the building of iron merchant vessels and men of war. The sultan of Turkey consulted him in 1837 on the machinery for the government workshops in Constantinople.

Together with Robert Stephenson, the son of George Stephenson, Fairbairn constructed the tubular railway bridges across the Conway and Menai Straits.

Fairbairn gave much attention to the building of steam boilers, and originated a number of improvements in them. Incidentally, he helped carry on some scientific experiments, in 1851, of the melting points of various materials under pressure, and from 1861 to 1865 guided the government experiments on the use of iron in defensive warfare.

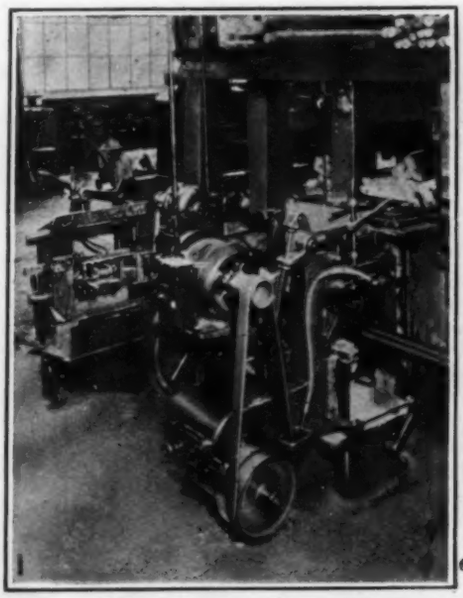
He died in 1874.

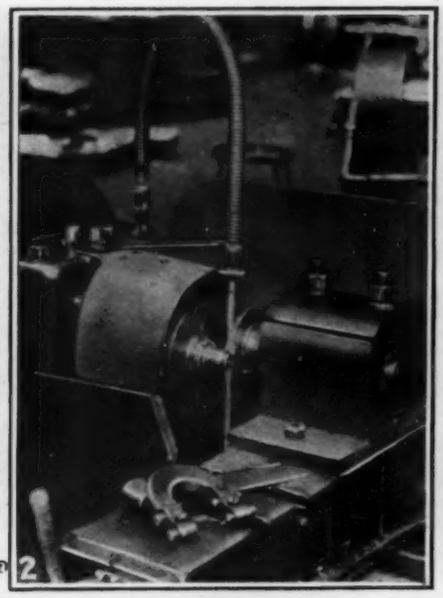
Where Machine Tools Are Made

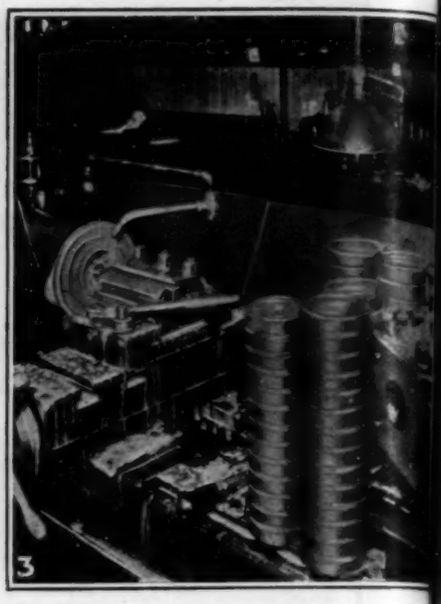
The John Steptoe Company

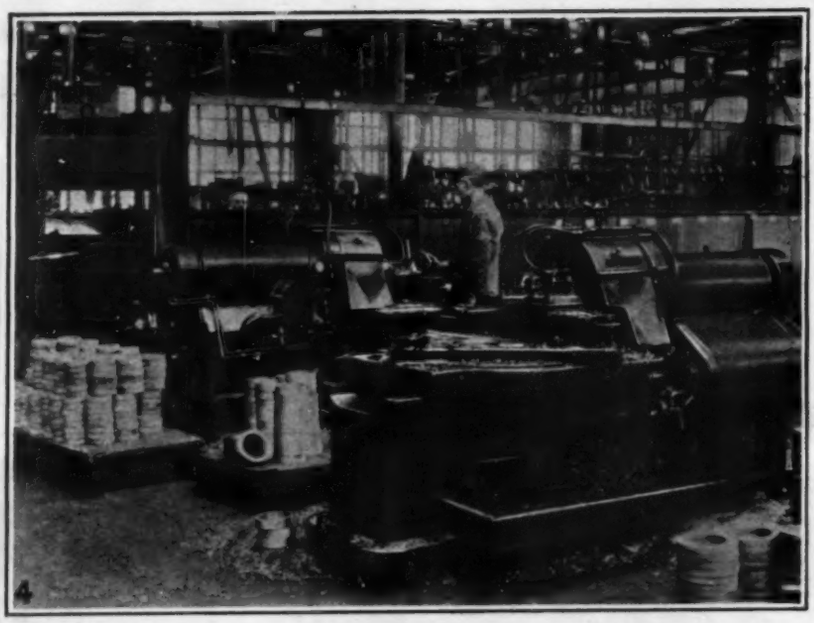
Cincinnati, Ohio

Established 1845









Production Work on

Fig. 1—Cutting samples for laboratory tests

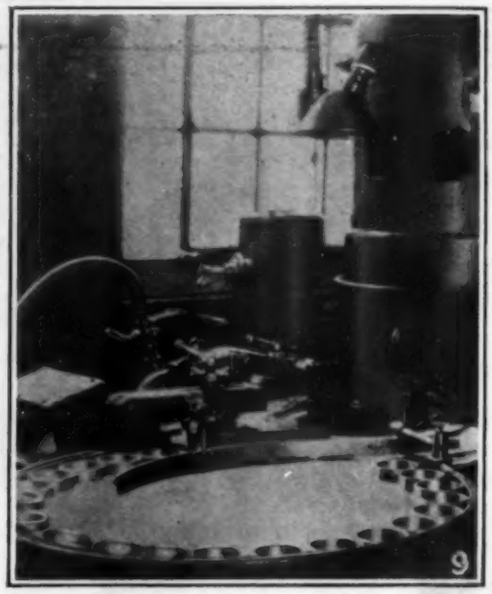
Fig. 2—Forming ball race on inner ring

Fig. 3—Forming ball race on outer ring

Fig. 4—Boring, facing and turning large rings on Simplimatic

Fig. 5—Forming ball race in Stub lathe

Fig. 6—Gas-fired hardening furnace and tank



on Ball Bearings

Fig. 7—Grinding ball races on Van Norman machine

Fig. 8—Grinding outside of rings

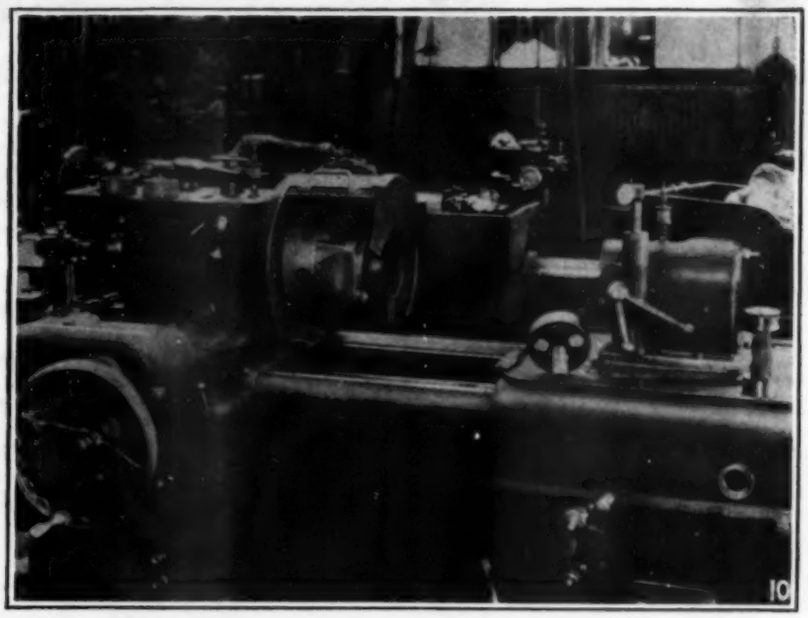
Fig. 9—Feeding rings to Blanchard grinder from special table

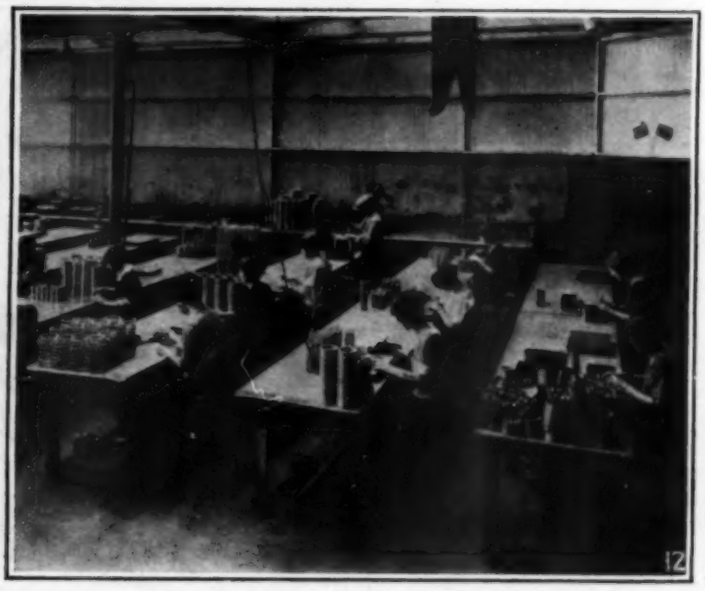
Fig. 10—Grinding outer rings on Teromatic

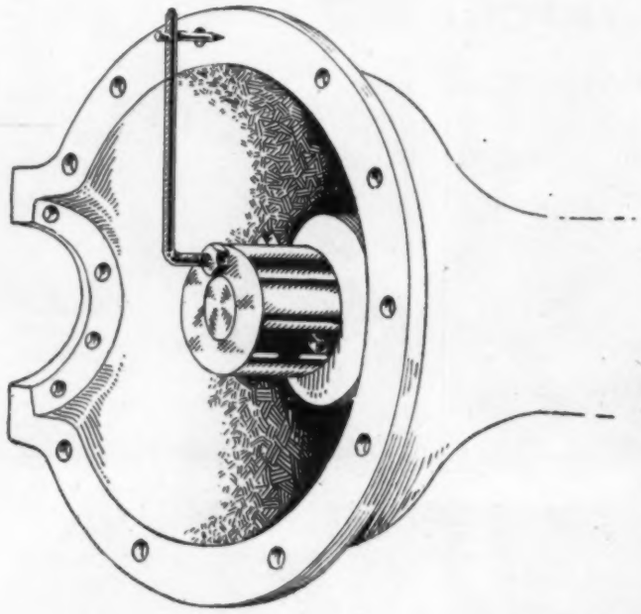
Fig. 11—Section of inspection department

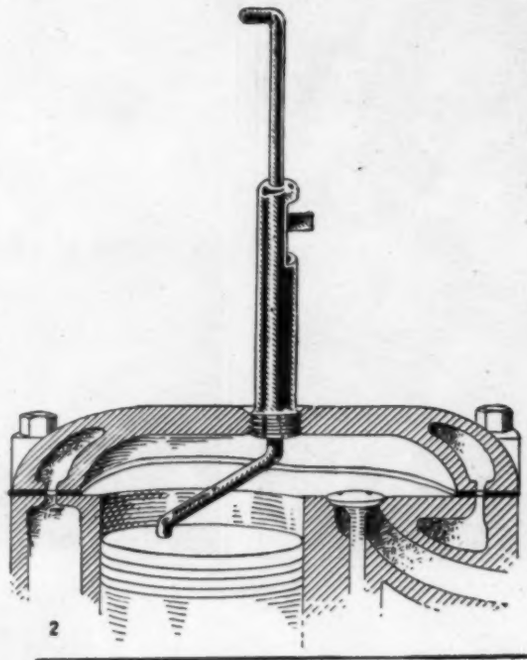
Fig. 12—Part of the assembly department

Photographs by courtesy of Strom Ball Bearing Mfg. Co.

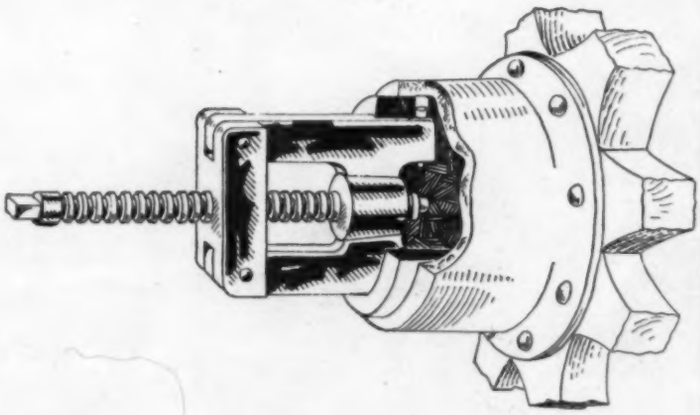








2



Some Tools Used in Hupp Service Stations

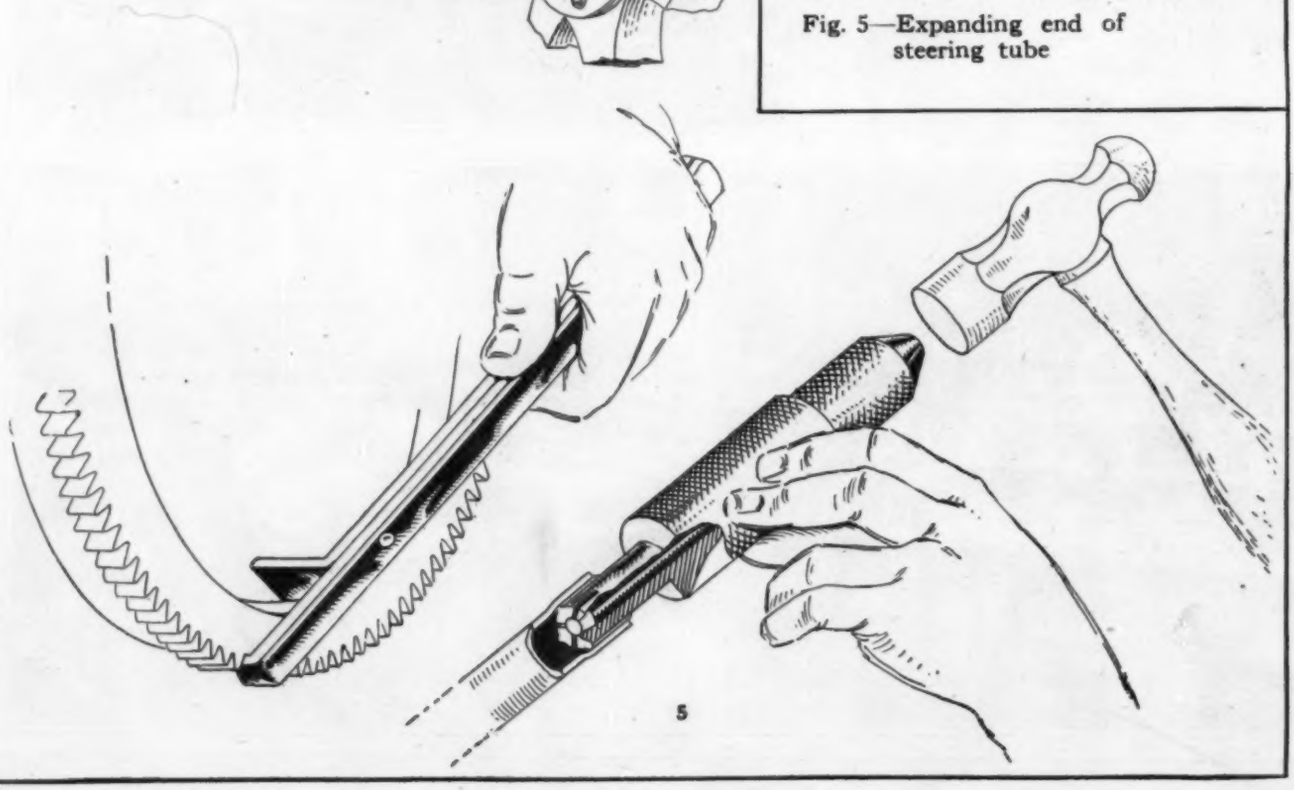
Fig. 1—Testing differential housing

Fig. 2—Locating top of stroke

Fig. 3—Pulling outer race from wheel

Fig. 4—Wrench for turning flywheel

Fig. 5—Expanding end of steering tube



5

How to Estimate Machine Shop Costs

By Albert A. Dowd

Continuation of procedure in making estimates for planing work — Examples of planing estimates — Speeds, feeds, and contingent and setting-up time

AS A FURTHER example of planing work, consider the part shown in Fig. 43. This piece is also of cast iron, finished on the pads and on the bottom. Both bottom and pads call for a rough finish as the pads are to be scraped to fit another piece later. A single roughing cut is sufficient for the bottom and two roughing cuts for the pads, the first cut being at a feed of $\frac{1}{8}$ and the second cut at $\frac{1}{16}$ in. per stroke.

The shape of this work permits a secure method of clamping and it would naturally be set up so that the 22-in. width reaches across the table. We could easily use both heads for roughing off the pads, the right-hand head taking the 2-in. and 4-in. pads and the left-hand head taking the other 4-in. pad. The finishing cut would naturally be made entirely with the right-hand head. We must therefore, really consider that there are three operations, although only two settings of the work. If we set up four pieces in line with about 3 in. between the pieces for clamping, we will have $(18 \times 4) + (3 \times 4) = 84 = L$. The width of cut for the right-hand head is $4 + 2\frac{1}{2} = 6\frac{1}{2}$ in. The distance between the pads naturally requires hand feed but this can be done rapidly and it is hardly necessary to make an allowance for it, if the width of feed allowance is made sufficient to cover it. If we follow the line of procedure previously outlined, our problem will present itself as follows:

$$W \times F = N = 6\tfrac{1}{2} \times 8 = 52;$$

$$\frac{L}{12C} + \frac{L}{12R} = (T + S) =$$

$$\frac{84}{12 \times 50} + \frac{84}{12 \times 100} = \frac{7}{50} + \frac{7}{100} = 0.21$$

$(T + S) \times N = 0.21 \times 52 = 10.92$ min. for roughing cut.

For the second cut on the pad, the feed would be finer, say $\frac{1}{16}$ in. per stroke. Since this feed is one-half of that allowed above, the cutting time will be doubled, giving 21.84 min. for the second cut. The roughing cut across the bottom of the work would probably be done first, but it makes no real difference for the purpose of estimating. The cutting speed would be about 50 ft. per min. with a feed of $\frac{1}{8}$ in. per stroke, a single cut being all that is necessary. The width of cut plus the allowance should be about $22\frac{1}{2}$ in.

$$W \times F = 22\tfrac{1}{2} \times 8 = 180 = N$$
$$(T + S) = 0.21$$
$$(T + S) \times N = 0.21 \times 180 = 37.8 \text{ min.}$$

If we allow 15 min. for the first setting and the same amount for the second, we shall have in all 30 min. for setting-up time. By adding the times for the various cuts and the setting-up time, a total of 100.56 min. is found to be the amount required for four pieces. If we allow about two hours for getting the machine ready and for contingent time we shall have as a final result, assuming 100 pieces in the lot,

$$\frac{100.56 \times 100}{4 \times 60} + 2 = 43.9 \text{ hrs. for the entire job.}$$

Castings of this size would probably weigh in the neighborhood of 250 lb. each and a helper would therefore be required in setting up the work. On all large castings it is wise to allow a little extra time on account of the greater trouble in handling the pieces, and for this reason it would probably be well to estimate 45 hrs. for the job.

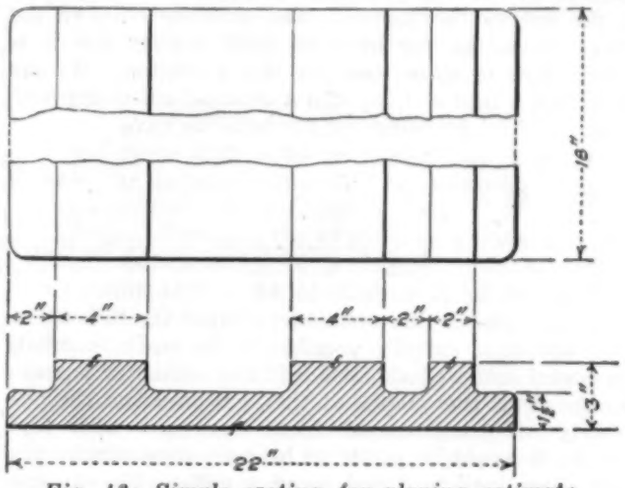


Fig. 43—Simple casting for planing estimate

We shall now take up an entirely different class of work, an example of which is shown in Fig. 44. This piece is a casting which is to be finished accurately on the bottom and on the Vees in good commercial fashion, ready for scraping. There are a number of important considerations which apply to work of this kind when estimating the length of time necessary to make the cuts. The work must be placed on the table of the machine by means of a hoist, requiring additional time, and in setting up the work the operator must go to considerable more trouble than on simple work. By using surface gages and making measurements where necessary, he can determine approximately the amount of stock to be removed to bring the work to the required finished dimensions.

The inequalities of the rough casting require the use of shims to provide a rigid foundation and, as considerable metal is to be removed, the method of sup-

This is the fourteenth article of the series. The thirteenth was concluded on page 615 Vol. 61, No. 16.

porting and clamping the work must receive consideration. Attention is called to the lugs on each side of the casting and, as these are to be bored later in relation to the finished surfaces of the ways, the operator would undoubtedly plug the holes with wood and locate the center approximately when setting up. By this means variations in the castings would cause no discrepancies in the location of the holes when boring. All of these matters take a considerable amount of time, yet they cannot be omitted or slighted, if good work is to be produced. As this particular piece of work is 82 in. long we will consider handling only one piece at a time.

The material is cast iron and there are no interruptions in the cutting. We shall assume that three settings are required, the first for roughing the bottom of the work, the next for finishing the other side, and the final setting for removing sufficient stock at the bottom to maintain the over-all height. In considering the first setting let us first note the amount of cutting to be done. We have a flange on each side 2½ in. wide by 82 in. long and one head only would probably be used for this cutting, although a skillful operator might possibly make use of both heads. The work must be set up and clamped very rigidly in order to withstand the heavy cutting, for on a casting of this size there would be an allowance for finish of not less than ¼ in. on a side. Making due allowance for variations in the casting, we can consider that 5½ in. is the total width of the cut on the flanges. The distance between the flanges would be fed by hand quite rapidly and it is unnecessary to allow time for this operation. We can safely use a feed of ⅛ in. with a depth of cut of approximately ⅞ in. Applying the formula, we have

$$W \times F = 5\tfrac{1}{2} \times 8 = 44 = N$$

$$(T + S) = \frac{L}{12C} + \frac{L}{12R} = \frac{84}{12 \times 50} + \frac{84}{12 \times 100} = 0.21$$

$$(T + S) \times N = 0.21 \times 44 = 9.24 \text{ min.}$$

At first glance this seems very rapid for this operation, but it is entirely possible if the work is solidly supported and well clamped. If the estimator has any doubts about the quality of the iron used and the possibility of using coarse feeds combined with high speeds, it would be better to be more conservative and slow down both feed and speed a trifle. We can use, for example, 40 ft. per min. for the cutting speed and a feed of ⅛ instead of ⅛ in. Under these conditions the cutting time will be found as follows:

$$W \times F = 5\tfrac{1}{2} \times 10 = 55 = N$$

$$(T + S) = \frac{84}{12 \times 40} + \frac{84}{12 \times 100} = 0.245$$

$$(T + S) \times N = 0.245 \times 55 = 13.475 \text{ min.}$$

For setting up this work an ample allowance must be made, remembering at the same time that in a lot of 50 pieces the operator will grow more proficient during the progress of the work. He would probably spend at least an hour, and possibly an hour and a half, in setting up the first piece, but the average for the lot of 50 pieces should not be more than from 30 to 45 min. To be conservative we will say 45 min., so that the total time for this operation can be considered to be 13.475 + 45 = 58.475, or a fair allowance of one hour. Here is an example where it takes considerably longer to set up the work and remove it from the table than it does to do the cutting.

For the second setting of the work we have a roughly finished side on which to set up and there should be no great amount of time necessary for the handling and adjustments prior to the cutting. With suitable hoists the work should be set up in about 20 min. including the time of removal after cutting. Let us refer to the illustration and note the amount of cutting to be done on the Vees and surrounding surfaces. In the first place the top of the Vees must be planed to establish a working surface and the edges *D* and *E*, as well as the ledges *F* and *G*, must be planed in relation to the holes *B* and *C*. The various cuts and their

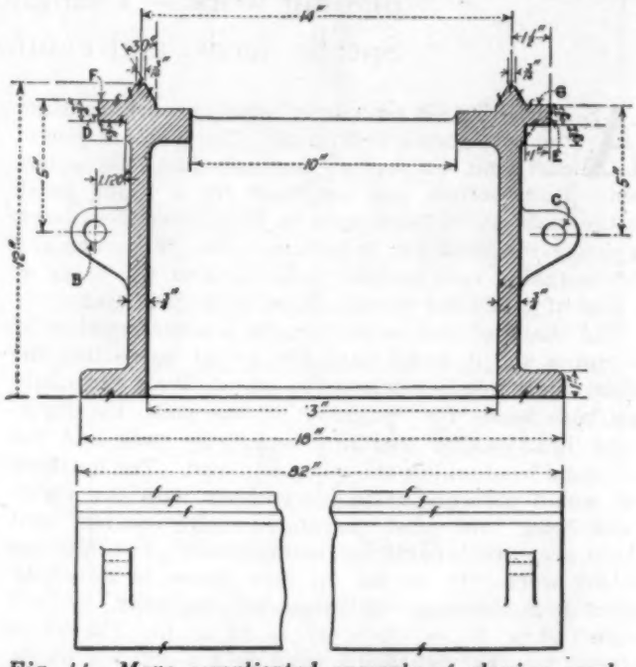


Fig. 44—More complicated example of planing work

sequence would depend somewhat upon the operator, but the amount of surface to be covered would be the same no matter what sequence were used. Both heads of the machine would be operated simultaneously on some of the cuts, while on others the right-hand head only would be used. To obtain the correct center distance of 14 in. between the Vees a templet gage should be provided.

In taking the first cut across the top of the Vees a speed of 40 ft. per min. with a feed of ⅛ in. could be used, the finer feed being more suitable because it leaves a better working surface from which to determine other depths. For this first cut we would make an extra allowance for width, because considerable finish would be provided on these surfaces in order to get a good quality of iron when finished. It would not be too much to allow for a ½-in. cut on the top of each Vee plus a small allowance, making in all 1½ in. for the cut.

$$W \times F = 1\tfrac{1}{2} \times 32 = 48 = N$$

$$(T + S) = \frac{L}{12C} + \frac{L}{12R} = \frac{84}{12 \times 40} + \frac{84}{12 \times 100} = 0.245$$

$$(T + S) \times N = 0.245 \times 48 = 11.76 \text{ min.}$$

To this amount must be added the time necessary for cutting and trying to obtain the proper depth, so that the height will be maintained. Several cuts and a test with a surface gage will be necessary and we should

probably need to allow 8 or 10 min. additional, giving a total of 11.76 + 10 = 21.76 min., or in round numbers 22 minutes.

We can now make the roughing cut on the shoulders *F* and *G*, using both heads. They cannot both be used together to advantage, however, so that we should allow sufficient time for both cuts being made separately. If we figure 2½ in. total and allow additional time for hand feed we will not be far wrong. The feed should be about the same as in the preceding case, although ⅛ in. would not be bad.

$$W \times F = 2\tfrac{1}{2} \times 32 = 80 = N$$
$$(T + S) \times N = 0.245 \times 80 = 19.6 \text{ min.}$$

Additional time for hand feed would be about 5 min. and the total for this operation would be 19.6 + 5 = 24.6 min., say 25 minutes.

Without changing tools the surfaces *D* and *E* can now be cut down, using both heads at the same time. As the depth is ¾ in. plus the finish allowance, we can allow about 1 in. on each side. One head would naturally be started first and the operator would then go to the other side of the machine and start the other head, making suitable measurements when so doing. Hence we should allow additional time for this operation of about 2 minutes.

$$W \times F = 1 \times 32 = N$$
$$(T + S) \times N = 0.245 \times 32 = 7.84 \text{ min.}$$

The additional allowance of 2 min. gives 9.84 min. for this operation.

The tools must now be changed for undercutting the flange and facing the ¾-in. surface below it. The roughing cut can be made with the same tools for both surfaces and hand feeds must be employed to some extent. The easiest way to allow for this is to consider that each pad surface is somewhat wider than it really is and then use the formula as before. For instance, if we consider that the surfaces are 2 in. wide instead of 1 in., this extra allowance should be sufficient to allow for hand feeding. We have also a down cut of ¾ in. and by combining the widths of the two surfaces and calling it 3 in., we will have allowed sufficient cutting width to cover the necessary hand feeding operation.

$$W \times F = 3 \times 32 = 96 = N$$
$$(T + S) = 0.245$$
$$(T + S) \times N = 0.245 \times 96 = 23.52 \text{ min.}$$

An allowance for left-hand head setting of 2 min. gives 25.52 min. for this operation.

We have now roughed all surfaces except the angles of the Vees and for these the heads must be set over to suit the angle. There are two angular cuts to be made with each head and part of the cut must be done by hand feed. If we allow for a distance of about ¾ in. on each angle and multiply this amount by 4, we shall probably be not far wrong for the actual cutting time, not including the allowance for setting the heads and the cutting and trying. The time allowance depends largely upon the operator and his experience on this class of work. One man might make the setting in 15 or 20 min. while another would take from half an hour to an hour. For normal conditions we might assume 30 min. and we would have

$$W \times F = 4 \times 32 = 128 = N$$
$$(T + S) = 0.245$$
$$(T + S) \times N = 0.245 \times 128 = 31.36 \text{ min.}$$

to which should be added 30 min., the time for setting the heads, giving a total of 61.36 min. for this operation.

As the heads have already been set at the correct angles, the finishing cuts should be taken at this time. This operation requires the surfaces to be brought to size and we should allow for at least two cuts on the angles, allowing about the same amount of time as in the roughing cuts, exclusive of the head setting. This gives 62.72 min., and to this should be added enough time to cover contingencies, say 30 min., making the time for the finishing operation 62.72 + 30 = 92.72 minutes.

The other cuts required on this piece can be worked out in the same manner as those noted and it seems unnecessary to discuss the matter further, except to caution the estimator not to omit contingent time for tool setting and incidental movements from the summary. In a large shop it should be possible to obtain records on previous work of a similar character to use as a check on the estimate, although small differences in the construction and in the various requirements of the work may make a considerable difference in the time required. However, it is much better to make a careful estimate, than to use guesswork and base the estimate entirely on previous work of the same kind.

It must be remembered that feeds, speeds, allowances and other factors in production are determined largely by experience on work of a similar character. Whether the type of machine tool used is ancient or modern is also a large factor. These points are obviously of the greatest importance and the estimator must have first-hand knowledge of the machines on which he makes estimates and their possibilities.

Effect of Nickel on Steels

According to Circular No. 100 of the Bureau of Standards the principal effects of the addition of nickel to steel are the following:

Nickel depresses the critical temperature ranges of steel, and according to the degree of such depression we may consider three groups of nickel steels—namely, pearlitic steels, which have normal transformation heat-treatment or critical ranges and are similar to ordinary carbon steels in a general sense; martensitic steels, self-hardening but too brittle to be of any importance commercially; and austenitic steels, which are not susceptible to hardening by thermal treatment, and may perhaps more properly be considered as ferro-nickel alloys containing carbon. The nickel and carbon content of the steel determine its inclusion in any one of the above groups. Nickel dissolves in the ferrite of steel and increases the hardness and strength without a corresponding loss of ductility. Thus, for forging grades of ordinary nickel-steels in the natural—that is, not heat-treated—condition, the addition of each 1 per cent of nickel up to about 5 per cent will increase the tensile strength and elastic limit by from 4,000 to 6,000 lb. per sq.in. without loss of ductility.

Nickel exerts an influence on the grain size of ferrite and pearlite, tending to produce a finer grain-structure and finer pearlite, shading into sorbite. In the same sense it diminishes the rate of grain growth within the heat-treatment temperature ranges, and thus minimizes the danger of overheating during heat-treatment.

One way to judge a foreman is to watch one of his men when he is asked to do some hurry job on Saturday afternoon.

Ideas from Practical Men

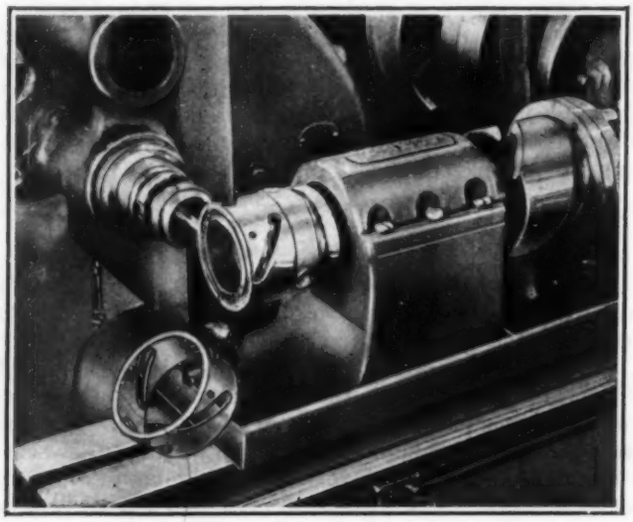
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Fixture for Milling Helical Slots

BY HENRY DENSMORE

The illustration shows a fixture designed for milling the helical slots in the sleeve of the style-C, H. & G. self-opening die, in which the chasers are controlled by a partial rotation of that member. It is used on a hand-milling machine, the table of the machine being fastened against traverse movement.

The spindle of the device is double, one part within the other, and is supported by a bearing that is long



Fixture for milling helical slots

enough and large enough in diameter to hold the work firmly to the cut. The inner spindle has an axial hole through it, threaded to receive a square-thread screw that is supported in an outboard bearing and turned by means of a crank.

The outer spindle carries at one end a barrel cam, the active face of which is a helical groove corresponding in pitch to the helix to be cut. Behind the cam and also keyed to the outer spindle, is a two-position index plate with holes 180 deg. apart. A stud in the base of the fixture carries the roll for the master cam.

The inner spindle carries at one end a chuck to hold the work and at the other end a plate corresponding to and abutting against the index plate, and in this plate there is a spring-actuated locking pin. Both spindles move freely endwise as a unit, but the inner spindle has no end movement relative to the outer one. The inner spindle is free to turn within the outer one only when the locking pin is withdrawn.

As the feeding screw is held against endwise movement by its bearing, it follows that when it is turned, screwing into or out of the thread in the inner spindle, the latter must advance or recede according to the direction in which the screw is rotated. As the inner spindle can have no end movement relative to the outer one, the latter is obliged to follow it, but can do so only in the helical path determined by the master cam.

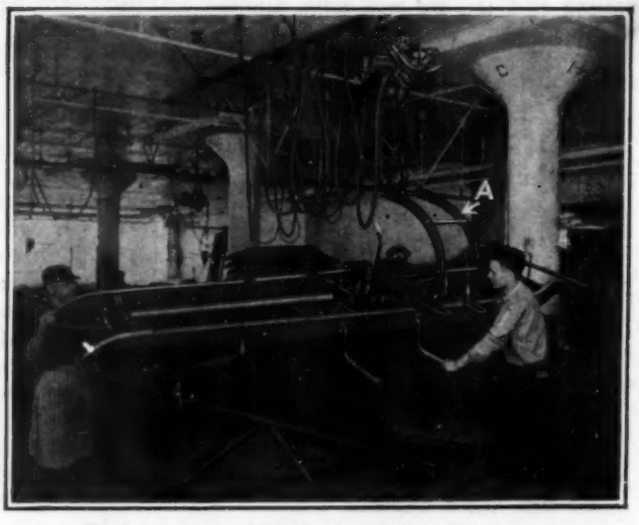
The sleeve to be milled, having previously had holes drilled radially through the wall at the starting points of the respective slots, is fixed on the chuck, in position for the small end mill in the spindle of the milling machine to enter one of the holes. With the end mill in the hole the feeding screw is turned, feeding both spindles forward in the helical path that the outer one is constrained to follow by reason of the roll in the master cam.

Having completed one slot the mill is withdrawn, the locking pin pulled out of engagement and the inner spindle turned a half-revolution, when the work is in position to have the operation repeated on the opposite side.

Self-Acting Clamp for Handling Automobile Frames

BY JACK YORK

Pneumatic appliances can be used to simplify many operations on automobile bodies and are particularly useful in assembling both chassis and the completed car.



A self-acting clamp for lifting frames

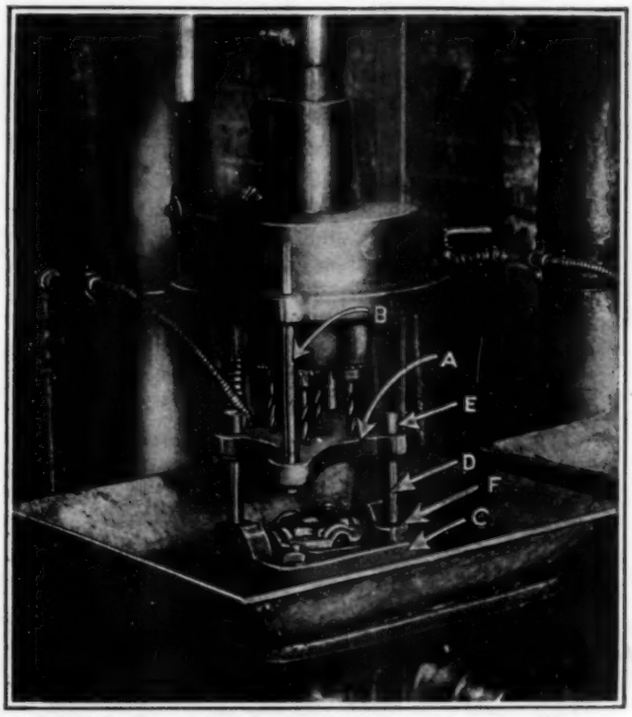
The illustration shows a Thor pneumatic motor hoist of 10-ton capacity made by the Independent Pneumatic Tool Co., used in lifting the frame of the Flint six from the fitting bench to the assembly line where additional units will be fitted. The feature in connection with this operation is the self-acting clamp *A*, which grips

the frame as soon as the hoist takes up the slack in the cable and begins to lift. In other words, the load tightens the clamp as in many devices used for handling sheet metal, locomotive tires and other work. Clamps acting in a similar manner can readily be devised for other work and the self-acting feature is a time saver both in attaching and removing them.

Bracing the Multiple-Drill Head

By William F. Sandmann

A multiple drilling head that is attached to the ordinary drill-press spindle quill is often placed under severe twisting strains, due to the fact that drills of different lengths are used and do not take hold together. If the drill that touches the work first is some distance away from the center of the head and hits a hard



Multiple head braced against twisting strains

spot some damage may result. Since no individual spindle adjustment is provided in the average drill head, it is quite a problem to keep the drill points in the same plane.

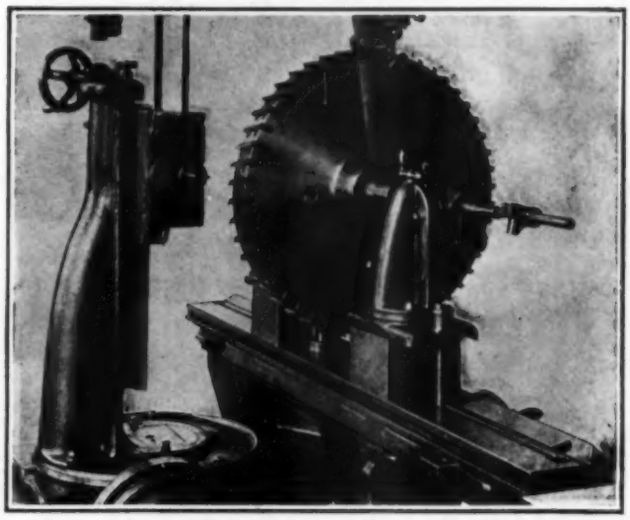
To remedy this condition in the drilling of a differential part, a jig was designed along the lines of a pillar die as shown in the illustration. The plate *A* carried the necessary drill bushings and was suspended from the drill head by the bars *B* at diagonal corners. The fixture *C* was provided with two pillars as at *D* which were a good slip fit in bushings *E*, the bushings being pressed into the plate *A* from the under side. The length of the bushings was made double the thickness of the plate so as to provide long bearings for the pillars.

When the drills were fed down to the work, the heads of the bushings *E* rested on the finished pads on the holding fixture at *F* and as the drills entered the work, the bars *B* passed on through the plate *A*. Since these bars were outside of the edge of the fixture *C* there was no interference.

Sharpening a Large Cutter

By Milton Wright

The illustration shows the set-up for grinding a 24-in. diameter inserted-tooth milling cutter designed to cut on both sides and the periphery. Owing to the unusual size of the cutter the methods employed were somewhat out of the ordinary, but no special equipment



Sharpening a large milling cutter

other than a pair of raising blocks was required. The work was done on a Brown & Sharpe, N-13 tool grinder.

The cutter arbor had centers in both ends, and to swing it up, a pair of plug centers with parallel shanks were clamped in the V-blocks of the universal work-heads, one of which belonged with the machine while the other was borrowed for the occasion from another machine of the same type. Raising blocks 4 in. high were necessary in order to swing the cutter clear of the table.

The wheel used to grind the cutter was a Norton 3360-I alundum, 6 in. in diameter by ¼-in. face. The periphery was nicked at irregular intervals, more as an experiment than from necessity. It would have been impracticable to use a cooling medium on the job, and the nicking was supposed to help in keeping the work cool.

The time on the job, including set-up, grinding and taking down, was about five hours. To grind the peripheral teeth of the cutter, the table of the machine was traversed past the wheel, while to reach the face teeth the cross-feed movement was used.

An Improved Dipping Basket

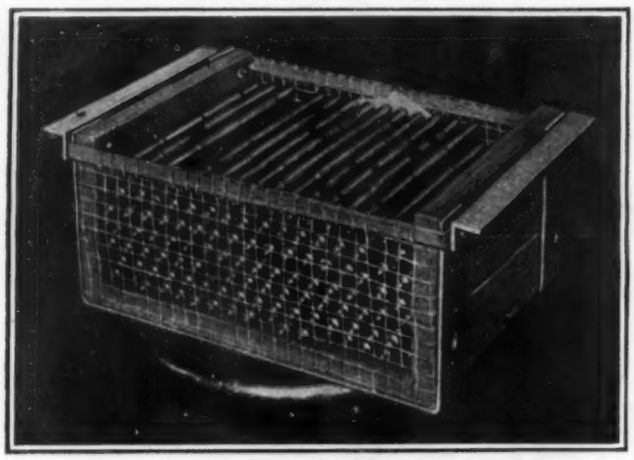
By William Denton

The illustration shows a dipping basket used in the Springfield, Mass., shops of the Westinghouse Electric & Manufacturing Co. for the purpose of washing the oil and dirt from small-motor armature shafts as they come from the screw machines upon which they are roughed out. The roughing operations leave the shafts with a center in both ends—and, incidentally, covered with oil and fine chips which must be removed before they can go forward to the finishing operations.

The basket is a framework made of flat strips and

small angles and is just wide enough to allow the shafts to lie crosswise. The sides are made of heavy open-mesh wire netting. The bottom and both ends of the basket are lined with wood to prevent the work from being marred by coming violently in contact with the bare metal of the basket.

The baskets of work are put through the usual course of boiling soda and are washed with hot water. As they



An improved dipping basket

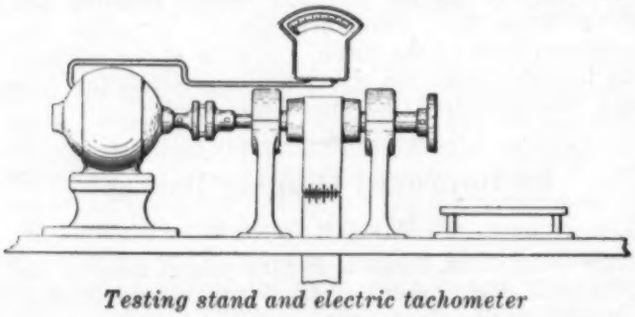
are lifted from the tank to the draining rack, a helper stands by with the nozzle of an air-hose and plays a jet of compressed air at 90-lb. pressure over the ends of the shafts exposed through the wire netting.

The jet of air drives out any oil or water that may have remained in the centerholes and at the same time blows away any fine chips that may have lodged therein to make trouble in the finishing operations. The cleaning is completed upon a basket of work in much less time than is required to describe it, and saves a very tedious job of digging out the centers individualy by means of a piece of cloth or waste and a stick.

A Simple Electric Tachometer

BY DONALD A. HAMPSON

A certain patented accessory for the automobile is made and tested in a contract shop, where a novel method of reading the speed is employed. The accessories are tested throughout a wide range of speed and



Testing stand and electric tachometer

their performance at different speeds must be noted. Power at a variable speed is belt-transmitted to the testing stand to which the units are coupled at one end.

No tachometer was available in the shop, but an excellent substitute was rigged up as shown in the illustration. To one end of the testing shaft, a small Hamilton Beach series motor was attached by a flexible coupling and the leads carried to a voltmeter set against the wall immediately in front of the tester, where the pointer may be read at a glance.

Since series-wound d.c. machines have a constant relation between speed and voltage, the voltage recorded is always a measure of the speed, and a dial may be laid off accordingly. In this case, a second series of figures was placed on the dial of the voltmeter to read speeds directly by the pointer. This series was laid off in pencil and then checked against various speeds read by a revolution counter before marking them permanently.

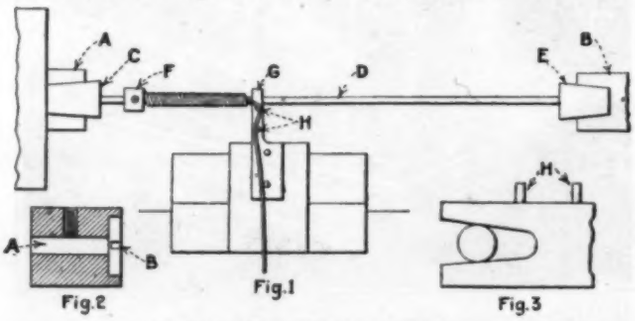
This arrangement makes the speed at various controlled points, instantly available for record and check and it does it without any of the time-lag inherent with some types of tachometers. Where dozens of tests are made every day, something better than a hand counter is imperative, and frequently the necessary parts are already in the shop. Though the speed curve of a series motor flattens at about 3,500 r.p.m., it is commercially accurate up to that point.

Mandrels for Winding Springs Discussion

BY DOUGLAS P. MUIRHEAD
Glasgow, Scotland

Referring to an article under the title given above, by E. Wilson and published on page 749, Vol. 60, of the *American Machinist*, the device illustrated herewith may be of interest.

As shown in Fig. 1, *A* and *B* are the head and tail spindles, respectively, of a lathe. A brass split-collet *C* fits in the live spindle and drives the mandrel *D* on



Device for winding springs

which the spring is to be wound. The mandrel is free to rotate in the brass bushing *E*, carried in the tail spindle. The wire is driven by means of the driver *F* which is attached to the mandrel by a safety setscrew. The driver is shown in section in Fig. 2. The mandrel fits in the central hole *A* and the end of the wire is bent into the slot *B*, by means of which it is driven.

Referring to Fig. 1, it will be noted that the pull of the wire is taken by the steadyrest *G*, carried in the sliderest. The steadyrest is provided with a tapered slot as shown in Fig. 3, in order to allow for the use of different sized mandrels, the thrust being taken by the inclined faces. The wire is fed around the two pins *H* in the steadyrest in the manner indicated in Fig. 1, giving tension to the spring as it is wound.

In operation, the lathe is geared to give the necessary pitch of the spring and the wire is fed by hand between the two pins as noted above.

While the Hjorth spring winder is an admirable little tool, it would be easier to use if the makers would send full instructions for its use with each tool.

The Bulldozer as an Aid to the Drop Hammer

By R. H. Howard

In the manufacture of certain heavy forgings, the use of the bulldozer as a preliminary machine to the drop hammer often proves not only a great aid to production but saves materially on the cost of the operation by eliminating expensive breakdown-hammer dies. An

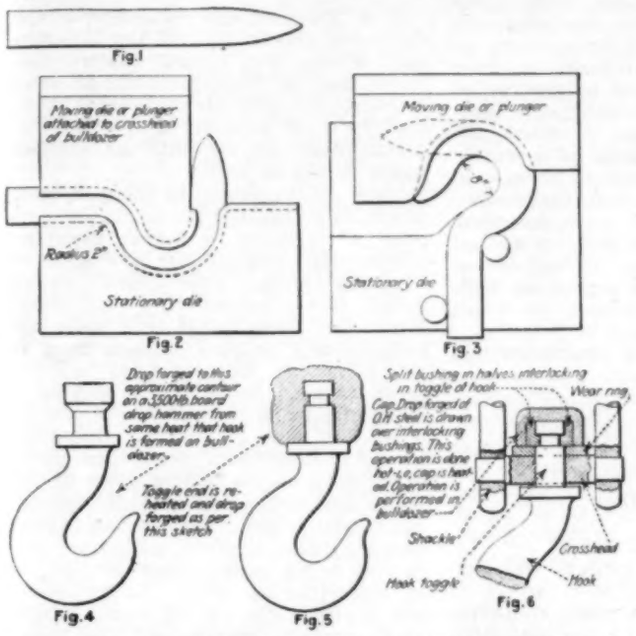


Fig.1
Moving die or plunger attached to crosshead of bulldozer
Radius 2"
Stationary die
Fig.2
Moving die or plunger
Stationary die
Fig.3
Drop forged to this approximate contour on a 3500lb board drop hammer from same heat that hook is formed on bulldozer.
Toggle end is reheated and drop forged as per this sketch
Fig.4
Fig.5
Split bushing in halves interlocking in toggle of hook
Wear ring
Cap. Drop forged of Diff. steel is drawn over interlocking bushings. This operation is done hot-i.e. cap is heated. Operation is performed on bulldozer
Shackle
Crosshead
Hook toggle
Hook
Fig.6

Fig. 1—The pointed billet. Fig. 2—First operation in bulldozer. Fig. 3—Second operation in bulldozer. Fig. 4 First drop-forging operation. Fig. 5—Second drop-forging operation. Fig. 6—Assembling operation

illustration is given in the steps of manufacture of the hook as shown in the accompanying sketches.

The hook is forged from a 6-in. round billet 42 in. long. The billet is heated to a good forging heat and pointed under a hammer, as shown in Fig. 1. It is then transferred to a two-stage die in a Williams, White No. 27 bulldozer. The first stroke of the machine forms a double bend in the billet, as in Fig. 2. This operation is very severe as the radius of one bend is 2 in. and the other 4 in., and often a peak load exceeding 75 hp. is indicated. The billet is next transferred to the second stage of the bulldozer die and another stroke of the machine completes the rough formation of the hook as shown in Fig. 3. The practically formed hook is then transferred to a drop hammer where it is drop forged. As the stock loses practically no heat in the bulldozer operations, it is not necessary to reheat the material for drop forging, thereby effecting an additional saving.

After forging the body of the hook, as shown in Fig. 4, the stock is heated on one end and the toggle connection is forged as shown in Fig. 5. The complete hook is assembled as shown in Fig. 6. The capping is done hot on the same bulldozer used for the second and third operations. This is a novel operation but is very effective and easily performed.

Purely bending operations, such as shown in Figs. 2 and 3 have a further advantage in that the grain of the metal is preserved, resulting in a stronger and better product. Hooks made by the methods outlined have stood up under extreme testing conditions. One hook only, partly straightened when a load of 456,000 lb. was applied. A slight deformation was also noted in the crosshead and shackle. The cap was not affected at all.

The weight of the finished hook alone is 330 lb. The weight of the hook assembly complete is 550 pounds.

Cross-Drilling Machine for Bars and Tubes

By C. Overton

A homemade automatic, cross-drilling machine for bars and tubing is shown in the accompanying sketch.

One man easily operates two machines and tool breakage is lessened while quality of the work is bettered.

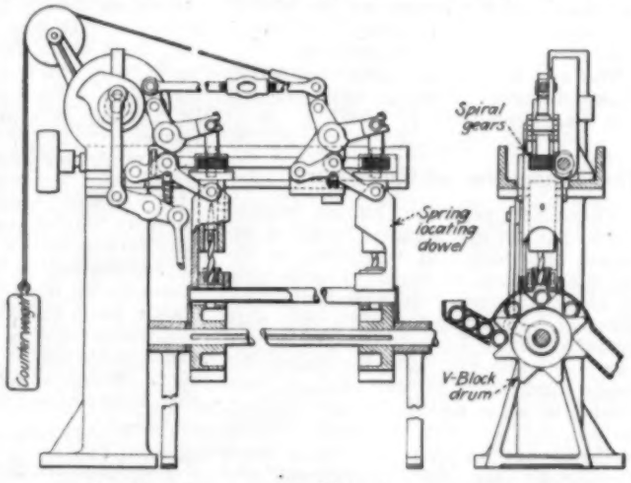
A plain column supports the rail at one end and if the rail is long a tie piece connects the outer end with a floor anchor.

The drive shaft has helical pinion-teeth cut on its entire exposed length, and near the rear of the rail and above the column the teeth mesh with those of a helical gear which drives the cam shaft, while the teeth of the drill-spindle driving gears mesh with them in any of the adjusted positions of the heads.

The drill spindles are fed downward and returned to idle position by bell cranks and adjustable linkage all actuated by the main cam above the column. Small auxiliary binding cams on the feeder bell-cranks, actuate hold-down devices timed to clamp the work while drilling and release it before indexing.

Motion taken from the main cam-shaft compresses the spring of a "load and fire" indexing finger and this rotates the cradle one station, when it releases. Direct ratchet action is sufficient for some jobs.

The main cams are readily removed and changed. The one shown in the sketch is for a hole through one side of the tube wall only. To drill through both sides of a large tube we use a jump-feed cam to rapidly carry



Machine for cross-drilling bars and tubes

the drill through the idle space until it meets the opposite side of the tube wall. The cradles are simply a couple of eight-pointed carriers in the V-notches of which the tubes are picked up from the gravity-feed chute and delivered through the discharge chute on the opposite side by gravity, after drilling.

Solid shafts are drilled by using a continuous cam, and on all cams the feed is slowed as desired at both the entrance and through positions of the drill, in order to prevent breakage.

Technical Abstracts

Equipment for Oil Burning

The ideal quantity of air required for complete combustion of fuel oil can be taken at an average value of 1350 cu.ft. per gal. The volumes refer to air at 62 deg. F. and 30-in. barometer. The rule which is often given of allowing 1,875 cu.ft. of air per gal. of oil allows about 40 per cent excess air, or rather 25 per cent to 40 per cent excess capacity in the blower. Pressures actually used in industrial practice runs from 4 oz. to 100 lb. per sq.in. In some domestic oil-burner installations, pressures are as low as ½ oz. It is stated that not all of the air need be supplied under pressure, for example, at 2 lb. only 30 to 40 per cent is required, while at 100 lb. per sq.in. only 8 per cent is required.

For low pressure burners, fans are used, supplying air at pressures up to 24 oz. per sq.in. Either positive pressure blowers or turbo-blowers are used for intermediate pressure burners. The pressure range of common turbo-blowers extends from ¾ to 4 lb. per sq.in., and the range of positive pressure machines from ¾ to 4 lb. ordinarily, and up to 10 lb. maximum with special types. For pressures from 20 lb. per sq.in. upward, piston compressors are used, except in large installations using large quantities of air, where turbo-blowers are often installed. It should be understood that on account of pipe-line losses, the pressure at the blower or compressor must always be higher than the pressure at the burner.

The article then proceeds to describe these different flowing units.—*Fuels and Furnaces*, Oct., p. 1,047.

The Education of Engineers

There are very few human institutions that do not require frequent revision and technical education is assuredly not one of them. Engineering in all its branches is essentially progressive. It changes rapidly, not only by introduction of new inventions and new methods, but also by change of trade conditions, as, for example, the coming of mass production and specialization. The subject with which students are expected to have some familiarity are more numerous and more complicated than they were thirteen years ago. For this and many other reasons it would seem that the time is ripe for a general review of the results now being achieved by technical colleges and by the system of practical training. Although this is an English editorial, we believe this sentiment will be echoed by most Americans.

There are two schools of thought, the advocates of one hold that the first duty of the teaching institution is to lay a firm foundation of established principles upon which the student may build as the times comes. The advocates of the other insist that education should be as wide and far reaching as possible. They would make it their object to give students an outline of many branches of science and technology and to present to them the very latest developments of scientific thought. There is much to be said in favor of both plans, but the former would seem to be the more desirable. It might be said that this latter method produces broader men. It may do so but it neglects in some degree the radical ground work of science on which broader knowledge must be founded.

On the question of apprenticeship, the editorial firmly states that an engineer cannot be made without actual workshop experience.—*The Engineer* (England) Sept. 19, p. 326.

High Manganese Steel for Locomotives

Some years ago a process was perfected for making a steel wheel in which the rim of the wheel contained about 1.6 per cent to 1.8 per cent manganese, with a gradual falling off in the manganese content until at the center it was about 0.6 per cent. This wheel, the Davis, is still made on a large scale. A steel similar to this was developed during the war and gained wide use. It was incorporated into a cast steel chain for anchors, but there have been other applications since of this high manganese steel and it is being used in some locomotive engine frames.

After proper heat treatment this has a high tensile strength coupled with a high elastic limit and satisfactory ductility. It contains about 0.035 per cent carbon with a manganese per cent approximating 1.7 giving a tensile strength of over 100,000 lb. with an elastic limit of over 50,000 lb. and an elongation in 2 in. of over 23 per cent, and a reduction in area of over 50 per cent. Microphotographs are shown of this material.—*The Iron Age*, Oct. 2, p. 824.

Time Loss in Reversing Planer Tables

Engineer Brandl points out that the reversal of the planer table means acceleration and that the time consumed in acceleration depends on the mass to be accelerated. He calculates that the acceleration time in a typical case adds 31 per cent to the time consumed in working. He emphasizes the desirability of fairly light design of the moving part and also of not using a planer for unduly heavy work pieces.—*Die Werkzeugmaschine*, July 30, p. 282.

Salvaging Waste Materials

R. S. Emmert, superintendent of the Salvaging Department of the Schenectady Works, the General Electric Co., states that the basic principle of scrap disposal at that plant is that they classify scrap as early as possible for consumption at the mill or smelter where it will be used.

They sell generally to the mill from which they purchase the stock, since its offer is likely to be higher than the competitive price offered by dealers or by other mills. This applies to all metal scrap, except iron and steel, which they have found sells more advantageously to junk dealers than to the mills. If they were to sell the scrap without handling and sorting it would not bring in over 50 per cent of what they now get for it. Operating the scrap department costs them about 6 per cent of the selling price of the scrap and the profit yielded therefor can be plainly seen. Scrap comes to them varying from obsolete automatic machinery to the mixed grease and copper of wire-drawing dies. Large pieces are loaded right on the cars; smaller stuff comes in containers. The standard scrap can is simply a steel oil drum, punched with two lined eyelets for handling by grappling hooks or cables on cranes and hoists.

Some details are given as to how scrap wire and cable are taken care of In most cases the insulation is burned off, the metal being left which is then sorted out and taken off to be remelted. Perhaps the most pretentious single operation in the scrap and salvage department has to do with the reclamation of babbitt metal. The only new material bought for the scrap department is metal for the babbitt room, tin, lead, antimony, etc. for rebuilding babbitt. A reverberatory melting furnace is operated for reclaiming lead dross, babbitt dross, etc. This furnace has a capacity of 25,000 lb. of metal in 24 hours.

Altogether the scrap and salvage departments employ between 45 and 50 men who handle about 50,000 tons of metal scrap annually that is worth at the present low market for scrap about $1,700,000 which can be considered the minimum amount received.

There is another salvage department devoted to getting out of paper, wood and lumber the value which might otherwise go to waste. All lumber, boxes, crates, scrap wood, sawdust and other refuse which cannot be salvaged at a profit is burned. In this department are two large wood-burning boiler equipments that supply part of the heat for the Schenectady plant. There are many illustrations given which help the text considerably.—*Factory*, Sept., p. 340.

Applications of Motion Study

Frank B. Gilbreth and L. M. Gilbreth contribute a second article on this subject. One interesting point brought up is the confusion that exists in the literature of scientific management between time study and motion study. Time study is the great invention of Dr. Taylor. Taylor never did any motion study of any kind whatever. The credit for this, in the abstractor's opinion, belongs to Frank B. Gilbreth. He defines motion study as "the science of finding the one best way to do work" and points out that this can be found not necessarily by time study, but by very careful study of the fundamental motions that enter into the complete cycle. When the best sequence is known, the one best way can be prophesied before anyone can demonstrate it.

Automaticity of the wrong method, so prevalent in highly repetitive vocations like those of the textile trades, is the shame and disgrace of industry today, but it is useless for executives and managers to talk standardizations of the correct sequences of the "therbligs" until they know from personal experience the possibilities of micromotion study and set the example in their own duties. If standards are based upon the permanent records of indisputable knowledge of the ultimate components of the cycles obtained by the micromotion methods, they will be in shape for cumulative improvement without any additional study. — *Management and Administration*, Sept., p. 295.

Reducing Manufacturing Costs

The longer the British depression of trade that now faces their engineering industry continues, the more urgent becomes the necessity of bringing it to an end. While losses accumulate or profits diminish, there is a tendency to seek new means of restricting expenditure and, as a result of the endeavors of manufacturers to effect economies, there must arise some degree of depletion of the productive capacity of their organizations. The result can only be that, when the long-expected revival occurs, they may be so placed that they will be unable to employ their "predepressionary" resources to the best advantage and thereby to reap the fruits of the increased demand. Few of the usual methods of restricting expenditure are indulged in for their own sake and it is too seldom realized to what extent the future is affected. One method and the most obvious, is to cut down the overhead which may mean, however, that important administration functions may be neglected. Many firms quite naturally are inclined in difficult times to consider the production of a new commodity. With the existing plant of a factory, this, however, is at all times a risky procedure. In so many cases the equipment on hand is not exactly adaptable to the new requirements, so that the process of manufacture must, from the nature of things, be more costly than that of a competitor whose factory is equipped with more suitable plant. Further, unless the new feature is to be a permanent one and considerable capital is expended on new plant, and new skilled workers are engaged or other workers are specially trained at considerable cost, it is only too likely that added loss will, in time, accrue from the change.

Another suggestion is that the methods of remuneration of labor should be examined to find the methods whereby incentive may be increased and higher output obtained without a corresponding increase in the pay roll. The improvement of organization and efficiency, by a close watch on small details, rather than by extensive alterations and additions, was advocated, while the application of scientific development to the question of reducing the bulk and increasing the strength of the materials used, was urged. It will be admitted that these suggestions are worthy of consideration by all manufacturers, but their application to any business demands a high degree of knowledge and appreciation of the situation on the part of the management. —*Engineering*, Sept. 19, p. 419.

Economical Maintenance Work

Theodore Clark, mechanical superintendent of the Eastern Manufacturing Co., takes up the question of methods of taking time studies and paying bonuses for non-repetitive work. He urges what he calls "common sense" times and takes for example the time for removing a 10x24-in. solid iron pulley from the end of a 2⅛-in. shaft and shows how by "common sense," the time required for removing an 8x24-in. pulley from the same sort of shaft can be rapidly and accurately deduced.

To a certain extent bonus enters into the times set for this maintenance job because of the unforseen difficulties which surround repair shop problems. It is only right therefore, that the men should be protected on the one hand against getting "trimmed" for too low cost from a difficult repair job and it is equally important to prevent the company from undergoing the same operation, when the job turns out to be remarkably simple. The bonus statistics that are given by Mr. Clark are somewhat elaborate to abstract, but for those interested in such matters the original article is well worth reading. —*Management and Administration*, Sept., p. 299.

Slinging Heavy Loads

It goes without saying that sling ropes or chains should not be passed over sharp edges without a suitable protection such as bagging, waste or wood being placed between the sling and the edge. Nor is it desirable to wrap the load chain around the load and catch the hook back over the load chain itself.

Another point which should be borne in mind is in regard to attaching the hook of a hoist load chain to the sling. The sling should be placed full in the saddle of the load hook, not on the tip, nor bearing excessively on that side of the hook. It is not unusual to open up a hook without taxing it to its full rated capacity by simply setting the sling carelessly so that the load bears too far out on the point of the hook. Sometimes, in slinging the load too many strands of the sling are passed through the hook. This causes the hook to open up, due to the side strain of the sling when the hook really has capacity enough to carry three and a half times its rated capacity, if the load is properly slung and suspended.

There are many illustrations showing how slings can be used effectively in conjunction with crane hoists.—*Industry Illustrated*, Sept., p. 32.

Continuous Heat-Treating Furnaces

Howard M. Groff of the Buch-Groff Co., Trenton, N. J., discusses the possibilities of continuous heat treatment and advantages that can be utilized in a great many more industries than those in which it now figures prominently.

Generally the heat treatment of a part precludes any possibility of further work on it except grinding and lapping. Such rapid strides have been made in the art of grinding and its application that many things heretofore considered impossible are now of daily occurrence. As an example, the continuous process of heat-treatment has recently been applied successfully to the production of small flat drills for drilling non-ferrous metals. Here the wire is hardened, tempered slightly in the coil, and fed from the coil through an automatic machine, where abrasive wheels grind the relief or back taper, flats, and cutting edges and finally cut the drills off. The additional working of the hardened wire by the wheels seems to impart increased life to the drills.

Illustrations are given of the continuous heat treatment furnace which may be treated by gas or electrically for hardening and tempering wire or strip stock.—*Machinery*, Sept., p. 10.

The Loss of Zinc in Brass Smelting

R. W. Mueller points out that for every 100 lb. of brass smelted down in a brass foundry about one pound of zinc is oxydized and passes out through the chimney as zinc oxide. He gives figures to show that it would pay to try to collect this and work it back to zinc again. A very pure product would be attained. He recommends settling chambers in which the zinc-oxide dust is either centrifugated out by change of direction of flow of the gasses or is allowed to drop out during a very slow passage.—*Die Werkzeugmaschine*, July 30, p. 283.

A New Spiral Drill for Aluminum

The firm of R. Stock & Co., A.G., in Berlin, has carried out investigations on the drilling of light metals. Drills of ordinary shape give unsatisfactory chips, run easily out of true, and wear fast. A new twist drill developed by the company, on the other hand, works very satisfactorily and has found friendly acceptance by the German industry. A picture of this drill is given. — *Die Werkzeugmaschine*, July 30, p. 282.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Railway Shop Men Welcome New Ideas

IT HAS been the belief in many quarters that railway shop men were averse to new ideas and were handicapped by traditions as to railway work being different from that of other shops. We were not free from this notion ourselves and, in fact, it had more basis in the days gone by than at present. More recent observations, however, convince us that there are many railway shop men who are not content to jog along in the same old ruts, and who welcome new ideas as to handling different kinds of work. Recent visits to several railway shops have shown numerous instances of new methods introduced from other shops, and the tendency is to welcome new ideas from any source.

New devices were shown that were the results of visits to other shops, and also to the recent convention of Tool Room Foremen. There were also visiting foremen and tool supervisors from other railroads, to see special devices whose merits had been heralded abroad. It is the custom on some roads to send men almost any distance to see new devices that have been favorably reported.

It is our observation that the men responsible for results in railway shops do more shop visiting and interchanging of ideas than is done in the average machine shop. There are many opportunities for improving methods in railway shop work but the average foreman is alive to the necessity for betterment and is endeavoring to keep abreast of the times so far as circumstances and equipment permit.

Profiting from the Example of the Other Fellow

IF YOU take a dipper of water from one side of a tank and empty it back again on the other side, you haven't changed the level of the tank one particle; you have not even changed the contents, you have simply stirred things up a little. If, however, you should take some water from one tank and empty it into another tank, you at once add something to the second tank; you have raised its level and there is a distinct change to be noted.

Specialized industries are much the same as tanks. Each industry as a rule is sort of a closed compartment to itself and it is not as often as would be desirable that something is added to it from the outside. This of course is speaking in terms of information and not of money. Too often a man will say, "Why, I am not interested in this information, it doesn't seem to have any bearing on what I am doing." Yet perhaps by a reasonable stretch of imagination and by a moderate effort, the information put before the man could be molded to suit his industry. If this is done, then some new information from an outside industry is added and the level of information and experience available in this particular industry is increased. Our tank simile fails in that the information taken from one industry does not subtract anything from that industry.

Industrial processes are very much alike in their fundamental elements. The work that Frank Gilbreth did in studying and analyzing the individual motions that go to make up the work of a bricklayer, for example, shows that the transporting of a brick from the pile to the work, laying it down, tapping it in place and proceeding to the next brick, is not so much different from the work of a drill press hand who takes up his piece of work, places it on the drill press table, "taps" it with a drill and then proceeds to take up the next piece.

The *American Machinist's* articles are not for any particular branch of industry exclusively; they have of course their special application but on the whole they are broad and fundamental enough to be applied to all industries. The conclusions and methods laid down from examples in the automotive industry can be applied to the railroad industry and vice versa. The two are not so far apart and it is plain that no great stretch of imagination is necessary to convert the terms of one industrial unit to those of the other in these articles. At any rate, the broad-minded, far-seeing man will find it profitable to watch the other fellow's example.

Passing the Hat for the World Aviators

IT IS difficult to believe that a rich and powerful nation would send some of its army officers on a dangerous mission and not provide for the legitimate expenses of the expedition. Yet unless we are misinformed, that is exactly what happened in the case of men ordered to make the round-the-world flight.

While it is easy to lay such a state of affairs to army red-tape, it looks like lack of consideration on the part of the superior officers not to provide in advance for all expenses to be encountered on the flight. If reports be true no provision was made beyond the regular travel allowance although it was known that this would not cover the personal expenses of the flyers. It is stated that these expenses ran into several thousands of dollars above the allowance and, though this excess is to be met from private sources so as to reimburse the officers, it is hardly a dignified proceeding for the great United States of America.

There is no question as to the devotion and loyalty of the world fliers. And yet the fliers cannot help feeling a trifle resentful toward a condition of affairs which orders them to undertake a dangerous mission and leaves it to the generosity of private individuals to see that they do not lose money, in addition to the hardships encountered.

It is high time that provision was made to cover contingencies that arise on expeditions of this kind. Leaving to private subscription the duty of making up the deficit is hardly in keeping with the dignity we have a right to expect in a country of this size.

The men who accomplished such a remarkable feat deserve better treatment at the hands of the country they served so well—for which they risked their lives day after day. It is humiliating to think that every expense was not provided for in advance by the government under whose orders they made the flight.

Shop Equipment News

Monarch Helical-Geared Motor-Driven Lathe

A geared-head lathe in which helical gears are used in the head is a recent product of the Monarch Machine Tool Co., Sidney, Ohio. The lathe is furnished in sizes from 14- to 30-in., all sizes being arranged for motor drive.

The salient feature of the machine is the headstock, through which eight spindle speeds are available. The motor drives a friction clutch pulley on the back shaft, the clutch being operated by means of the long lever above the headstock cover, Fig. 1. A view of the head mechanism is given in Fig. 2, from which it will be noted that the power is transmitted through helical gears that are always in mesh. The speed changes are obtained by three levers at the front of the machine, these levers operating double jaw clutches in the spindle driving mechanism.

The head is fitted with ball bearings throughout. The auxiliary shafts are mounted in bearings of the combined radial and thrust type and the thrust of the helical gears is taken on ball thrust bearings. Ball thrust bearings also resist the end thrust of the spindle, the main spindle bearings being of bronze. The gears are cut from alloy-steel forgings and no gears are located in the top cover plate.

The moving sections of the jaw clutches slide on squared sections of the spindle and intermediate shaft. All spindle speeds are selective and changes are made with the lathe running. The friction driving clutch is of the multiple-disk type and can be arranged for control at the headstock, as shown, or with apron control. There is only one point of adjustment for the clutch, and the adjustment is readily made from the outside of the machine.

The driving motor may be mounted on the headstock, attached to the rear of the headstock leg, or enclosed in the headstock leg, as shown in Fig. 3. A motor with a capacity from 2 to 3 hp. is required for driving the 14-in. lathe, and the motors for all sizes should run at a constant speed of about 1,150 r.p.m. With the motor operating at this speed the spindle speeds will range from 13 to 311 r.p.m. The connection between the motor and the driving pulley on the headstock may be made through gears, endless leather belt or a silent chain. The drive shown in Fig. 3 incorporates a leather belt with an adjustable ball-bearing idler.

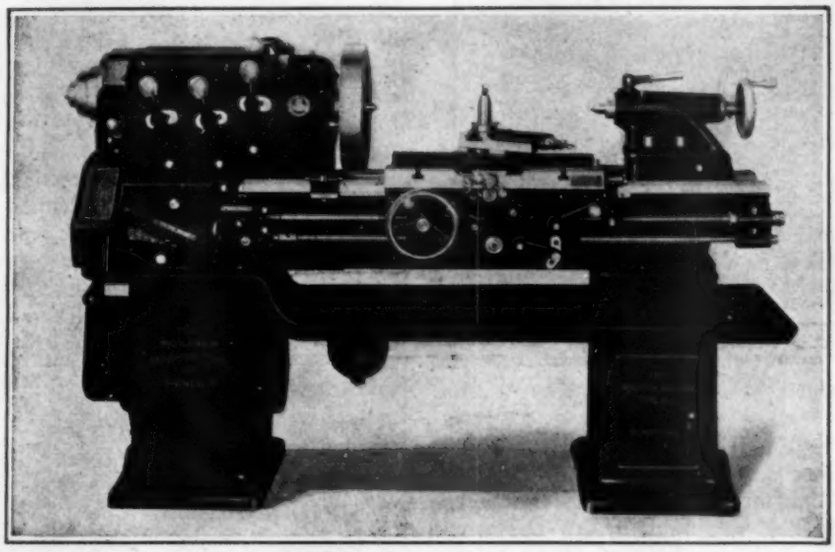


Fig. 1—Monarch Helical-Geared Motor-Driven Lathe

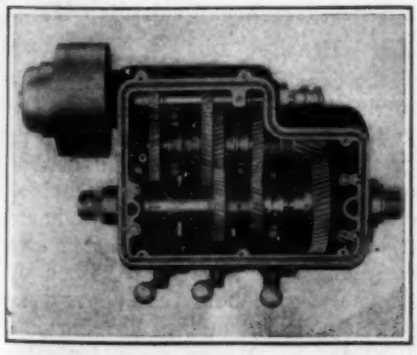


Fig. 2—Cover of Monarch headstock removed to show helical gears

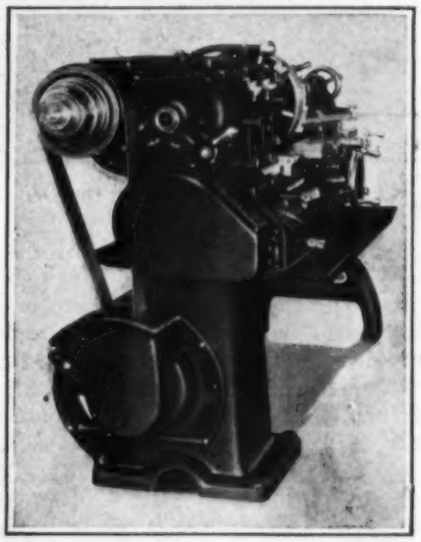


Fig. 3—Driving motor for Monarch lathe enclosed in the head leg

The 14-in. lathe has a swing of 14¼ in. over the bed with a 9¾-in. swing over the carriage, and the capacities of the other sizes are in proportion. Other dimensions of the 14-in. machine include a 1⅝-in. hole through the spindle, a No. 4 Morse taper in the spindle nose, and a center distance of 30 in. with the tailstock flush and a 6-ft. bed. The quick-change gear box provides a range of threads from 3 to 46 per in. and a range of feeds from 7½ to 115 per inch.

Cincinnati Plunge-Cut Grinding Machine

The Cincinnati Grinder Co., Cincinnati, Ohio, has recently added to its line of production grinding equipment a wide-wheel, in-feed grinding machine with a reciprocating spindle. The grinding is done by feeding directly into the work with a wheel whose face is sufficiently wide to cover the entire surface being ground. In the case of parts with ground surfaces wider than the greatest possible wheel width, the wheel is fed in along the work at successive intervals so that the cuts overlap, and the work is then moved rapidly past the wheel to complete it.

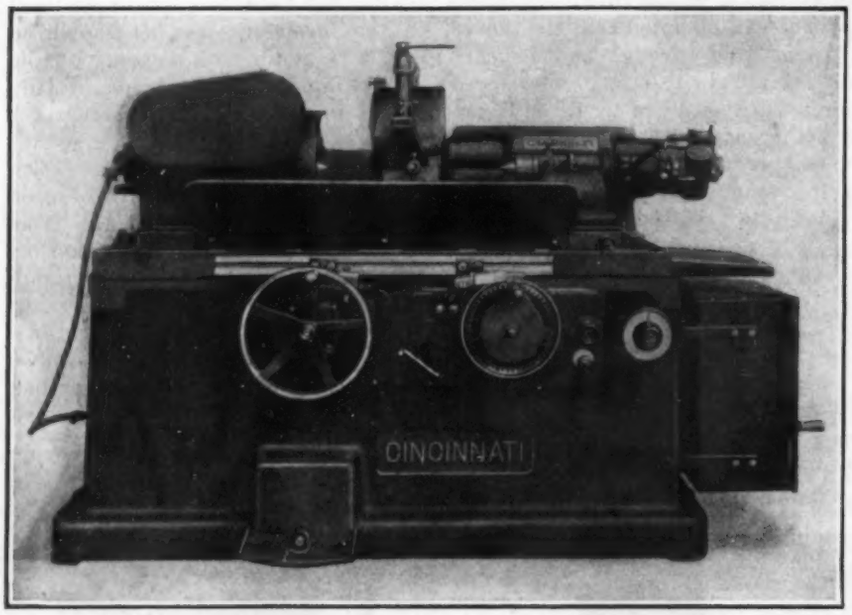


Fig. 1—Cincinnati 12x18-In. Plunge-Cut Grinding Machine

The machine is adapted to the grinding of duplicate parts, a number of which can be mounted on a mandrel, as well as for the grinding single pieces in quantity. The wheel base is fixed and the work table is movable, the wheel head being mounted on a slide that is moved across the machine by means of a suitable feed mechanism. The unit system is followed in the construction, each unit being assembled independently before being placed in position on the machine. About 20 hp. is required for driving and a motor drive is recommended.

The motor for driving the wheel and the one that drives the work headstock are both mounted on the machine, so that the entire apparatus is a self-contained unit. Both motors are dynamically balanced and are so mounted that they are convenient for adjustment, repair and replacement. The headstock motor is carried in the headstock housing, the main drive motor being placed partially in and carried by the machine base, as shown in Figs. 3 and 4. The main drive motor transmits power to the wheel spindle through an endless belt.

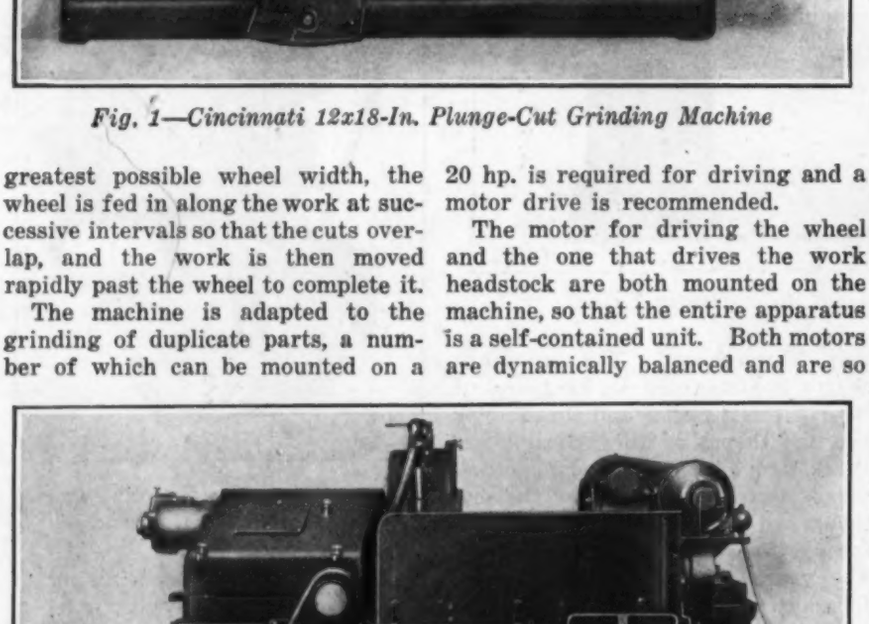


Fig. 2—Rear view of Cincinnati grinder with headstock panel cover raised

The wheel-slide platen is integral with the wheel-slide pedestal and water tank of the machine, and has one flat and one V-way upon which the wheel slide is moved. The relation of these parts is illustrated in Fig. 3. The wheel slide is held on the platen by its own weight and the pull of the belt. It is counterbalanced to prevent the possibility of jumping in when delicate adjustments are made or of lifting under heavy cuts.

The V-way is located about midway between the belt pulley and the wheel, the cross-feed screw and nut being positioned in the slide V-way. This arrangement is made to neutralize any tendency for the wheel-slide to skew on its ways. The wheel spindle is a heat-treated, chrome-nickel steel forging and runs in bearings of the half-box type. The body of the bearing is of cast iron and it is lined with white metal. The spindle is held down in the bearings by the pull of the belt and a shoe carried in the bearing cap provides a safeguard in case the belt should break. Automatic lubrication for the spindle bearings is obtained by the use of splashers that convey the oil to a collector in each bearing cap.

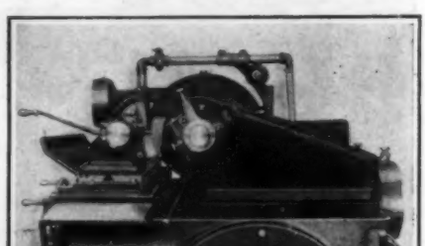


Fig. 3—Right-hand end of Cincinnati grinder showing driving motor application

A spindle reciprocating device is provided to move the spindle axially in its bearings through a distance of

$\frac{1}{16}$ in., if desired. The use of this device increases the length of time that the wheel face will remain even, and breaks up the grain lines of the wheel on the work. The wheel guard and cover are fabricated from boiler plate.

The main base casting has one flat and one V-way on which the sliding work table traverses. The table carries the headstock and footstock on which the work is mounted and driven, these parts being mounted on

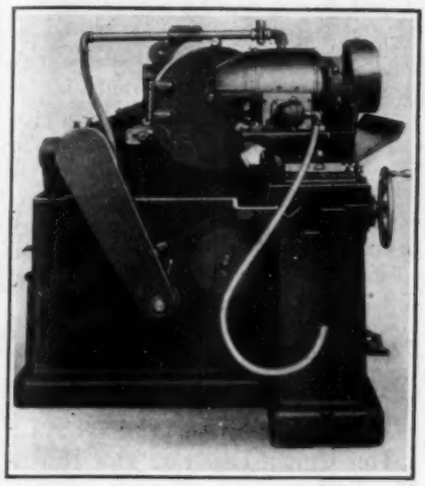


Fig. 4—Left-hand end of Cincinnati grinder showing arrangement of headstock motor

a swivel table that pivots on the sliding table. The swivel table can be set at an angle to the ways and permits the grinding of tapers without throwing the centers out of alignment. It is graduated to read in degrees as well as taper in inches per foot, and the adjustment is made by worm gearing at the table end.

The table traversing mechanism is hand-operated and is carried by a plate fastened to the front of the bed. The traverse mechanism is used to properly position the work in front of the wheel and to dress the wheel by means of a diamond held in a suitable device in the work footstock. A large handwheel is used to actuate the rack and pinion traverse through compound gearing. One revolution of the handwheel advances the table through $\frac{1}{4}$ in. Adjustable stops are provided for use in grinding accurately to shoulders.

The cross feed for the wheel slide is secured to the bed casting and is controlled by an index at the front of the machine. This device may be operated by power or hand. For hand-feeding a positive stop is used for duplicate work. The power feed can be automatically thrown out after the work has been reduced to the required and established size. The power feed arrangement gives a uniform feed and is driven by an adjustable-speed fractional-horsepower motor. The speed of the motor is controlled by means of a rheostat so that twelve feeds are available, ranging from 0.054 to 0.162 in. per minute in the reduction of the work diameter.

The headstock is adjustably mounted on the swivel table and has a stud spindle with a taper hole for the work-carrying center. The motor drives the spindle through a silent chain and a worm, the latter driving a wormwheel attached to the drive plate. The swivel table has a V-way into which suitable keys on the headstock and footstock fit. This arrangement insures proper alignment of these parts. The headstock motor controller is operated by a treadle.

The tank for the cooling water is located in the base of the machine and the water is circulated by a centrifugal pump submerged in the tank. The water guards are designed to break up the spray when wet-grinding and return the water to the settling basin and tank.

The machine is built in four sizes with a swing over the table of 13 in., and distances between centers of 19, 37, 49 and 73 in. respectively. The grinding wheels are all 20 in. in diameter and may be any width from 2 to 7 in. The floor space required varies from 68x117 in. for the smallest, to 68x171 in. for the largest machine. The net weights of the machines range from 10,300 to 13,400 pounds.

Hartness Bench-Type Screw-Thread Comparator

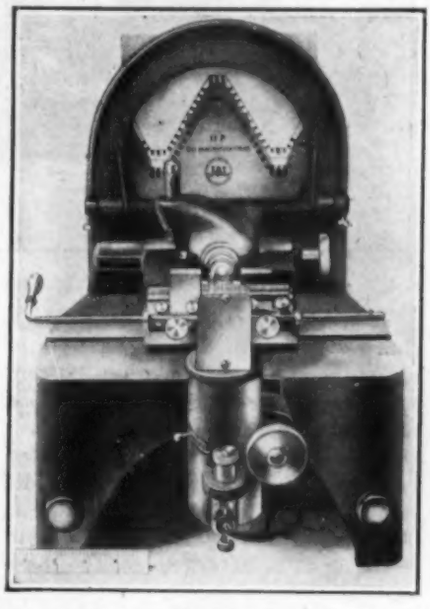
The Jones & Lamson Machine Co., Springfield, Vermont, has recently brought out a model of its screw-thread comparator that embodies the same principles and accomplishes the same purposes as the standard machine, but is much more compact and convenient to handle. It also has the advantage of not requiring any darkened room or special compartment of any kind.

A 6-8 volt, 32 c.p. Mazda lamp is located in a chamber in the base of the machine, its light passing upward through condensing lenses that produce a parallel beam, the direction of which is changed to the horizontal by a prism. From the prism the beam passes through the projecting lens to a tilted mirror at the rear of the hood, by which it is reflected to a screen located near the front of the hood and directly before the operator.

The screw to be inspected lies in a cradle in such a manner that the threads are in the beam of light and their shadow is projected on the screen. The screen is a tracing-cloth chart of a perfect screw thread drawn to a 50-to-1 scale. Two outlines appear on the chart, representing maximum and minimum dimensions, and the distance between them is the allowable tolerance.

A master screw of the same size and thread as the screws to be inspected is first laid upon the cradle, the proper screen is set into the hood, and the cradle is adjusted until the image of the thread projected by the lens matches the outer line of the chart. The screw to be inspected is then substituted for the master screw and any departure in lead, contour or diameter will be revealed by reason of the displacement of the magnified image on the screen.

A transformer to reduce 110-volt alternating current to the 8 volts



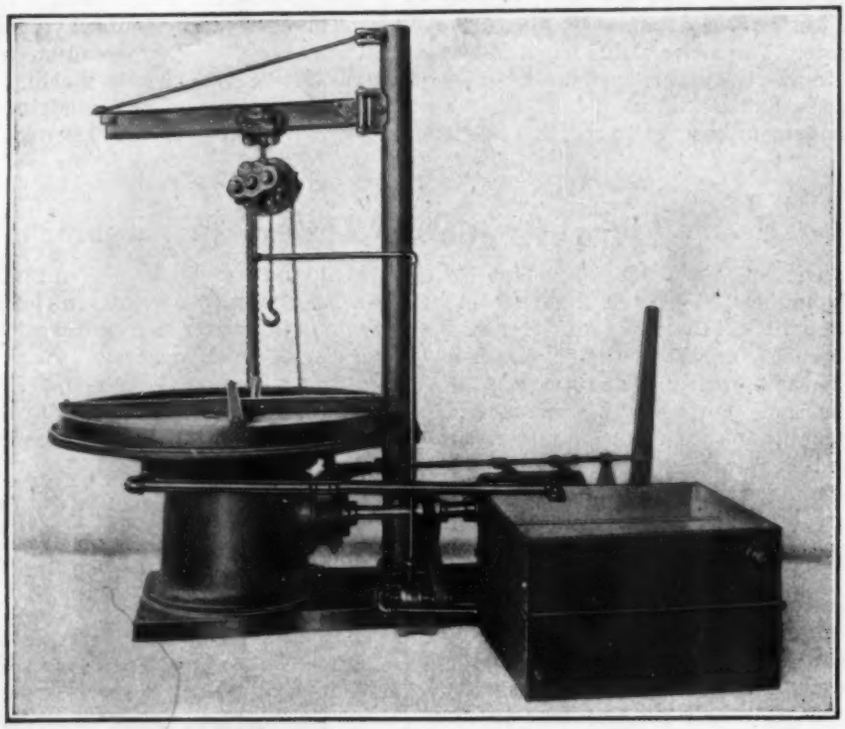
Hartness Bench-Type Screw-Thread Comparator

required by the lamp is a part of the equipment of the machine, and is located in the base. By removing the mirror from the rear end of the hood an opening is left for the light rays so that the image may be projected directly upon a large screen in a darkened room in the same manner as was done with the former machine.

Besly 53-In. Horizontal Disk Grinding Machine

A recently marketed product of Charles H. Besly & Co., 118 North Clinton St., Chicago, Ill., is a 53-in., belt-driven horizontal disk grinding machine, designated No. 29. The machine, as shown in the accompanying illustration, is equipped for wet grinding.

The floor plate of the machine carries the main base and an outboard pillow block bearing for the drive shaft. The main base is circular in shape and is machined on bottom and top for fastening to the floor plate and the top housing, respectively. The lower radial and step bearing for the disk wheel spindle is located at the bottom of the base. The drive shaft bearing is a unit in itself and is attached to the base casting.



Besly 53-In. Horizontal Disk Grinding Machine

Bevel gearing is used to transmit the power from the drive shaft to the spindle. Both the pinion and the gear are made from steel and the ratio is 2.5 to 1. The base forms a large oil reservoir and the bevel gearing runs in this oil. For access to the parts in the base an opening with an oil-tight cover is provided. The driving pinion has a hardened steel thrust collar running against a flange on the phosphor-bronze bearing bushing.

The top housing is cone-shaped and has a solid web running from the base to the outer edge. The upper radial bearing for the spindle is mounted in an opening at the center of the housing. At the bottom of the cone is a circular partition between the outer edge and the central part of the housing so that there is an opening clear around under the grinding wheel. This is used as a suction chamber for dry grinding and as a receiving drain when wet grinding is being done.

The grinding spindle is 3⅞ in. in diameter and is mounted in ball bearings. These bearings are carried in removable housings fitted into the frame of the machine as mentioned above. The bearings are protected against grit and dirt. The wheel collar to which the disk wheel is attached is shrunk on the top end of the spindle and is 10 in. in diameter.

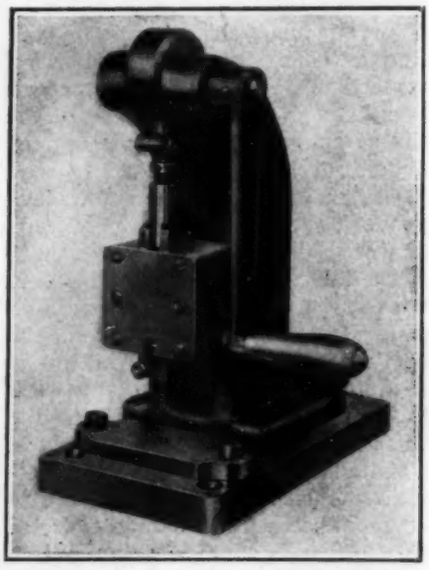
The steel disk wheel is 53 in. in diameter and 1¼ in. thick. It is fastened to the wheel collar by six ¾-in. screws. The abrasive disks are made in four segments and are attached to the wheel by the proper Besly cement to suit the type of grinding work that is to be done on the machine.

When used for wet grinding, a circulating pump, piping, and a three-compartment settling tank are furnished, as illustrated. A guard ring attached to the upper edge of the top housing collects the water from the outer edge of the disk wheel. A jib hoist is attached to the machine for handling heavy pieces of work and removing the disk wheel.

When it is necessary to true the surface of the abrasive disk, a truing device is attached to the top edge of the guard ring. This device consists of a 4x1-in. steel bar mounted on suitable brackets for attaching to the guard ring. A cross-slide is mounted on the bar and fitted to traverse it from the center of the wheel to the edge. A vertical slide on the cross-slide carries the wheel dresser and has a screw-operated feeding device for accurate setting.

Union Hand-Operated Punch Press

The Union Tool Co., 299 Norton St., Rochester, N. Y., has recently placed on the market a small hand-operated punch press. The machine is suitable for small forming, perforating and blanking work.



Union Hand-Operated Punch Press

As shown in the accompanying illustration, the machine is 13¾ in. high and weighs 46 lb. The maximum die space is 2½ in. and a 1½-in. adjustment is provided. It is stated that the machine can be operated faster than a foot press and with practically no hazard to the operator.

Arter Automatic Cylindrical Grinding Machine

The Arter Grinding Machine Co., Worcester, Mass., has just placed on the market a machine for the automatic production grinding of small parts not more than 4 in. long by 4 in. in diameter that can be held on centers. This company has taken over the patents, good-will, etc., of the Warren F. Fraser Co., formerly of Westboro, Mass., and the present machine is a modification and development of the original Fraser grinder.

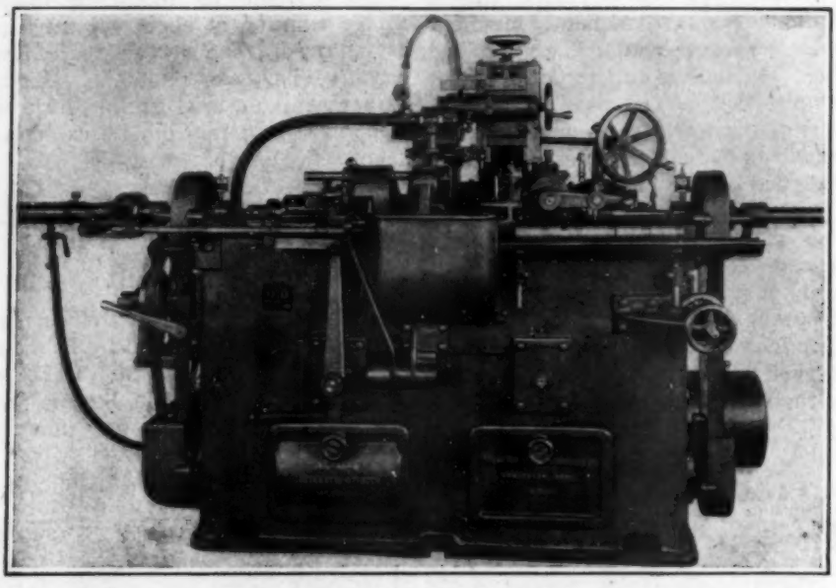


Fig. 1—Arter Automatic Cylindrical Grinding Machine

Automatic feed is provided by means of a turret in which the work is carried from the loading position to the grinding wheel and thence to the discharging position at the front of the machine. At this point the pieces are pushed into a trough that conveys them to a suitable receptacle or to a stacker, according to the nature of the work. The machine shown in the accompanying illustrations is set up to grind the pistons of automotive engines, and the finished work may be seen in the trough to the right of the turret.

The individual pieces are placed by hand in the turret each time an unloaded work-holder is brought to the upper position by the intermittent indexing movement. On work of comparatively small diameter and where the shape of the piece permits, the loading can be done automatically from a stack. The turret revolves on a horizontal axis, but does not at any time move endwise or sidewise. During the actual grinding time it is stationary.

As each piece is presented at the grinding position by the turret, the centers move inward in unison and lift the work clear of the holder but without removing it. The diameter of the opening in the holders of the turret must be suited to the work, being enough larger so that the work will no longer touch the wall of the holder at any point when located on the centers. At the same time the center of the work must not lie below the line of centers to the extent that the centers will not enter the holes.

Both centers are positively driven in unison. The driving pulleys are supported in bearings mounted upon the machine base independent of the heads and drive the spindles through floating couplings. Thus no belt strain is imposed upon the work spindles. The work spindles run in parallel adjustable sleeve bearings of bronze, and the end thrust is supported by ball thrust bearings.

The forward movement of the work spindles is caused by coil springs behind them. A cam is arranged to separate them at the completion of a cycle, and if a workpiece should become displaced in the turret so that the centers would not enter the holes, no damage would result. This is the so-called "permitted" movement, and is applied to all important functions of the machine. It is positive only in the direction of withdrawal and, should anything happen to prevent normal action, the net result would be to automatically stop the cycle.

The work heads are clamped to the bed of the machine by means of T-head bolts and the spindles move endwise in their bearings. The drive for the spindles includes an intermediate shaft with a 5-step cone, so that five speeds are available for different diameters of work.

The wheel-head moves to and from the axis of the work in conjunction with the indexing movement of the turret, the movement being derived from the same camshaft within the base of the machine. In this case a square-thread screw of large diameter, corresponding to a cross-feed screw, is so mounted in the base of the wheel-head that it may be given a definite and periodic movement endwise through a limited range. It is moved outward by its cam lever and inward by the pressure of a large coil spring, the inward movement being arrested by a fixed stop. The screw has no rotative movement.

In the sliding member of the wheel-head there is a large bronze nut inclosing the screw and so mounted that it may be rotated by means of the large handwheel shown in Fig. 1 to the right of the operator's position. The rotation of this wheel alters the relation of the grinding wheel to the axis of the work but does not affect the amplitude of its movement. The effect of a forward turn of the handwheel is to reduce the diameter of the work. The adjustment may be made at any time without regard to the cycle. A dial graduated to 0.0005 in. is provided.

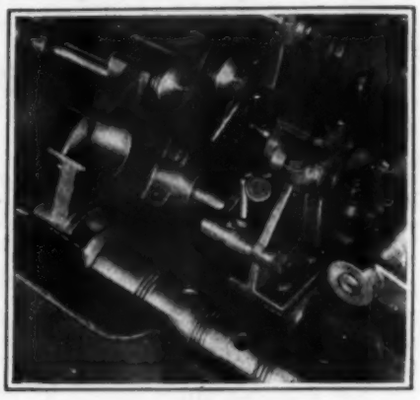


Fig. 2—Close view of Arter work-holding turret

The grinding wheel is moved

radially toward the work without traverse. Means are provided to give the wheel spindle an endwise movement if desirable. The amplitude of the movement is about ⅛ in., and its purpose is to distribute the wear of the grinding wheel evenly and prevent the grinding of "rings" in the work.

The stationary base of the wheel-head may be swivelled to any angle up to 5 deg. for the purpose of grinding tapered work. Under this condition no endwise movement of the wheel spindle can be permitted. Graduated adjusting screws are provided, by means of which angular settings may be made.

The grinding wheel spindle runs in plain bronze bearings. The outside of the sleeve in each case is tapered and fitted to a tapered seat in the wheel head so that compensation for wear may be made. The grinding wheel is located outside the main bearing, so that the changing of a wheel involves no disassembling of bearings.

The driving pulley is 5 in. wide, and is located between the bearings. Belt tension is maintained by a spring-suspended idler that runs upon ball bearings. There is an oil reservoir in the head from which a pump delivers a constant supply of lubricant to the spindle bearings.

A hand-operated diamond wheel-truing device is permanently mounted upon the wheel-head. The guide for the diamond is a hardened steel templet that corresponds to the contour of the work. The machine may be driven by belt, if so desired, but is designed to accommodate an individual motor of any size up to 15-hp. The motor drives the first shaft through a flexible coupling. All equipment for flood lubrication of the work can be furnished with the machine. A tank, containing a submerged centrifugal pump, is bolted to the rear of the base.

Defiance No. 10 Special Valve-Hole Drilling Machine

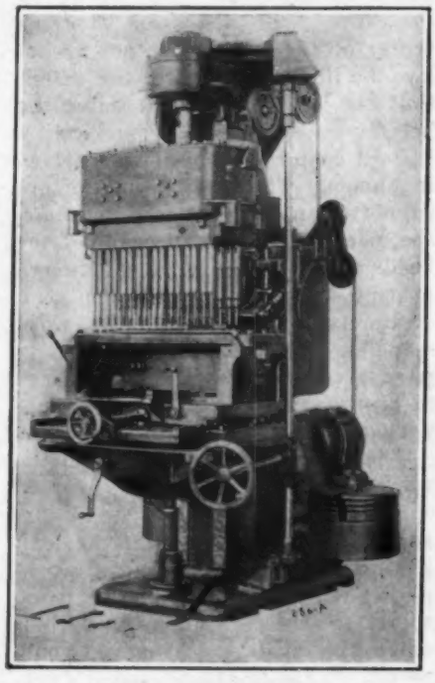
For boring, reaming, counterboring, and spot-facing the holes in cylinder blocks for the valves and valve stems, the Defiance Machine Works, Defiance, Ohio, is now marketing its No. 10, special, valve-hole drilling machine. The machine is shown in the accompanying illustration and is of the multiple-spindle, fixed-center type. It is designed for valve-hole operations on a straight-line, eight-cylinder block and has 32 spindles in the head.

The fixed-center head can be made with any number of spindles to suit requirements, and a head can also be furnished with adjustable spindles in a straight line. The maximum over-all dimension of the adjustable arrangement is 30 in. and the minimum distance between spindle centers is 2 in. The spindle ends have the No. 3 Morse taper.

Both power and hand feed, as well as rapid traverse, are available. The feed mechanism incorporates friction and hardened-jaw clutches that run in oil. The power for feeding is delivered from the drive shaft of the machine through hardened steel gears. The thrust of the clutches is taken by SKF ball bearings. The head is moved up and down by means of the feed screw, and is counterbalanced by weights attached to it by chains.

The table can be furnished in either the knee or box type and is adjustable vertically. The adjustment is obtained through a crank lever that operates a heavy jack screw. The top surface of the box-type table is provided with T-slots.

The unit type of construction has been used throughout the machine, the head and the feed and speed box being separate units. Each unit is independent and can be readily removed, if necessary at any time. In the oiling arrangements the force-feed, gravity-flow and splash systems are combined. The speed and feed mechanism and the spindle head have separate oiling systems.

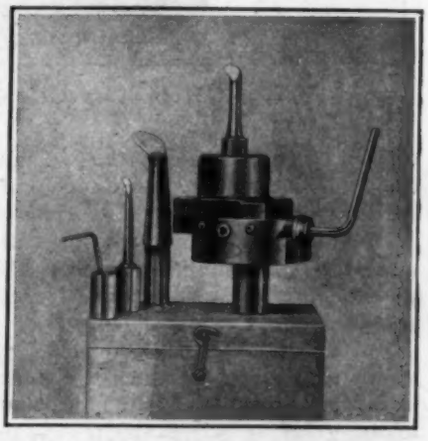


Defiance No. 10 Special Valve-Hole Drilling Machine

For driving by motor, a 15-hp. motor running at about 1,150 r.p.m. is required. The net weight of the machine is about 11,350 lb. Extra attachments such as holding fixtures and tools, cutting lubricant equipment, etc., can be furnished.

R & G Adjustable Boring Tool

A recent addition to the line of equipment manufactured by Ribbe & Grey, 308 Tecumseh St., LaPorte, Ind., is the adjustable boring tool shown in the accompanying illustration. The tool is fitted with a micrometer adjustment on the cross-slide and is adapted for use on drilling or milling machines.



R & G Adjustable Boring Tool

The construction of the shank makes the tool adaptable for use in a universal chuck. Straight- or taper-shank holders can be fitted for mounting in any machine spindle. The dovetailed cross-slide has a traverse of 1 in., the micrometer adjustment being graduated in thousandths.

A single wrench is used to lock the tool, operate the adjustment and lock the slide. Three tempered boring tools and two split bushings are included in the outfit. The shank is 1 in. in diameter by 1½ in. long and the body of the tool is 3⅛ in. in diameter. The net weight is 5 pounds.

Waterbury Farrel Bolt Head Trimming Machine

A recently marketed product of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., is an automatic bolt head trimming machine. This machine is used for trimming the heads of cold-headed bolts and screws to square, hexagonal, or other shapes. The machine is built in three sizes with capacities for blanks up to $\frac{5}{8}$ in. in diameter and from $\frac{3}{4}$ to 8 in. in length under the head.

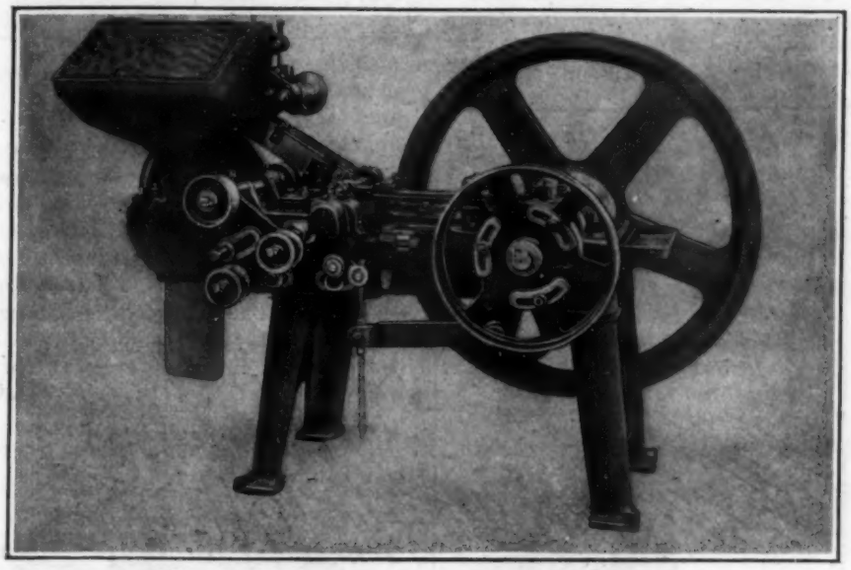


Fig. 1—Waterbury Farrel Bolt Head Trimming Machine

Blanks up to 4 in. in length are fed automatically from a hopper into a chute and thence to the device that transfers them to the trimming tools. Longer blanks are placed in the chute by hand. The blanks are picked from the side of the chute by a pair of spring carrier fingers attached to an oscillating shaft. The shaft is mounted in a cross-slide and, when the fingers are swung up to the chute angle, the slide advances toward the chute causing the fingers to snap over the blank. The slide then recedes with the blank in the fingers and the fingers swing downward to the position illustrated in Fig. 2. The slide again advances until the blank is on the center line of the tools, where it is held until encompassed by the tools that perform the trimming.

As the slide again recedes the fingers slip off the blank and, at the rearward position of the slide, the arm swings up to the chute angle in preparation for the next cycle. The hollow punch telescopes over the shank until it strikes the under side of the head and the head is then forced a short distance into the trimming die.

The cross-slide is cam-actuated, the cam lever being furnished with a safety device that prevents breakage in case the slide should meet an obstruction in its travel. The cam lever is made in two parts joined together by a flat spring attached to one and carrying a tapered lug that engages a groove in a plate attached to the other. If the movement of the slide is arrested by an obstruction the lug slips out of the slot and disconnects the drive. The innermost position of the slide is determined by an adjustable stop. The actuating cam has a slight overtravel and, when the slide strikes the stop, this overtravel is taken up by the compression of a spring between the cam lever and the slide. The spring between the lever and the slide can be seen in Fig. 2 at the top of the slide.

The oscillation of the finger shaft is also determined by positive stops at the extremities of its arc. The connection between the cam lever and the finger shaft has two coiled springs that take up the incompleted cam movement if the fingers strike an obstruction. This spring connection can be seen at the front of the machine in Fig. 1. This cam also has a slight overtravel and the excess movement is taken up by the same springs.

For medium and short work the blanks are pushed through the die in succession. The first blank is pushed into the die until its head is nearly trimmed, leaving the shank extending. The second blank is then brought to a position in front of the extending shank and acts as a ram by means of which the punch forces the first blank completely through the die. Longer blanks are trimmed and then ejected from the die by means of a knock-out. The change from one method to the other necessitates the relocation of the transfer slide in relation to the die. In order to simplify this adjustment the hopper feed and the cross-slide are mounted on an apron so that they can be moved as a unit.

The die knock-out is operated from the gate and consists of a pivoted lever, one end of which bears against a knock-out pin that extends through the frame of the machine into the die. With this method of trimming the nose of the punch is made small enough to enter the die and push the blank far enough to complete the trimming in one stroke. In all cases the hollow punch is provided with a spring operated knock-out pin. For exceptionally short blanks a special sliding spring punch must be used and the carrier fingers must be made thin enough to properly clear the punch as they recede.

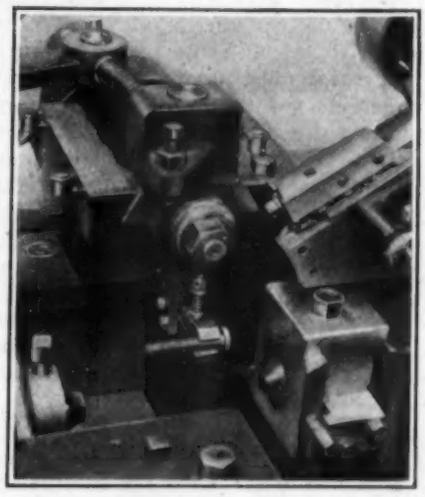


Fig. 2—Transfer device on Waterbury Farrel trimming machine

The two smaller sizes of the machine are direct-driven, the largest size being back-geared. The production rates of the machines are 65, 50, and 35 blanks per min., respectively, and they require 5, $7\frac{1}{2}$ and 10 hp. for driving. The net weight of the machines without countershafts range from 2,200 to 8,000 pounds.

Barnes Drill Co. No. 210 Drilling and Tapping Machine

With the purpose of producing a drilling machine that will be, in effect, a special machine for each job on which it is used, devoid of excess parts and with a direct connection between the motor and the drill, the Barnes Drill Co., 820 Chestnut St., Rockford, Ill., has developed and is now marketing its No. 210 drilling and tapping machine. The machine is self-contained, the motor being attached back of the head for floor-space economy. The motor is direct-connected to the drive shaft by means of a flexible coupling.

The head is securely bolted to the box-type column, this arrangement providing for the use of a raising block or a longer column where a greater distance is required between the spindle nose and the table or base of the machine. The head is a unit in itself, containing all the working parts, including the pump for the self-oiling system but not the coolant pump. The latter is located in the base and is driven by a vertical shaft inside the column.

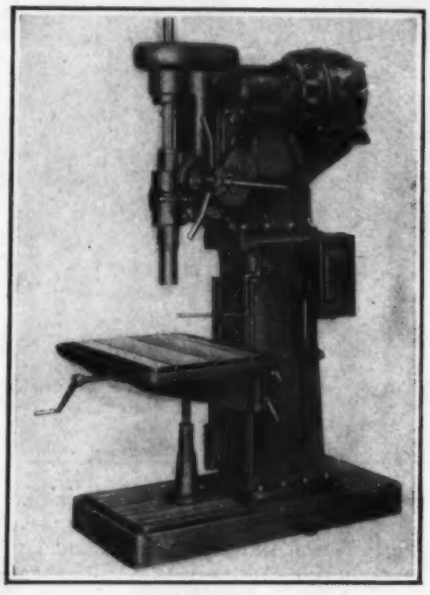
It has a wide range of adaptability but is intended for use as a high production machine. Slip gears are provided for any single speed from 100 to 2,000 r.p.m., a sufficient range to accommodate all high-speed drills from ⅜- to 1½-in. at their maximum working speed in any material. Slip gears also provide for a range of feeds from 0.005 to 0.047 in. per rev., and geared thread leading feeds can be provided for tapping operations. All gears are of heat-treated chrome-nickel steel.

The spindle is made with six splines, the crown gear being broached to fit. Keys are eliminated, together with the tendency toward binding of the spindle in the crown gear when tapping or when using a large drill with a heavy feed. The spindle thrust is taken by a roller thrust bearing that has a double row of staggered long and short rollers, designed for heavy work. The rack is attached to the sleeve by a patented dove-tail construction, in which a key is provided to take the thrust and screws are eliminated.

An automatic stop and a safety device are provided, the latter tending to prevent overloading and to minimize breakage of drills. The drift hole is below the sleeve and a No. 4 or No. 5 Morse taper will be furnished, as required. A star wheel for hand feeding is located on the right side of the machine. The spindle travel is 12 inches.

The table has a finished 17x28-in. surface, surrounded by an oil channel. It is gibbed to the column ways, to which it can be clamped at any height within its 17-in. travel. It is supported by the elevating screw, which serves as a jack.

A 5-hp., 1,200-r.p.m. motor is recommended. The machine can be furnished with tight and loose pulleys for belt drive, if desired. The floor space required is 34x48 in., and the net weight, without motor and starter is 1,700 pounds.



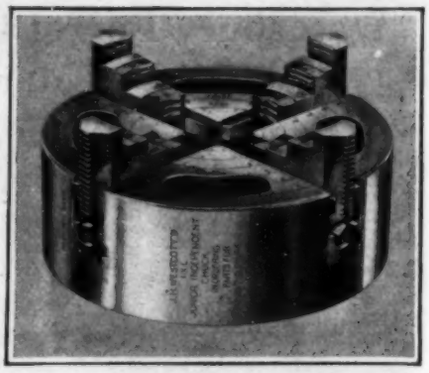
Barnes Drill Co. No. 210 Drilling and Tapping Machine

Westcott Junior IXL Independent Lathe Chuck

An independent lathe chuck, designated the Junior IXL, has recently been developed for use in manual training schools and for light lathe work in industrial machine shops by the Westcott Chuck Co., Oneida, N. Y. The design of the chuck is exactly similar to the standard chucks made by this company, the only difference being that the body, jaws, screws, etc., are relatively lighter in weight.

Each jaw screw is provided with a hardened steel carrier for the purpose of distributing the thrust, so that the body will not be sprung or broken. These screw carriers give hardened steel thrust bearings for the screws and can be replaced when badly worn. The jaws are made of steel and case hardened. They are carefully ground and fitted, are reversible and have deep shoulders. The screws are squared at both ends and tempered. The body of the chuck is of gray cast iron. All parts of the chuck are interchangeable.

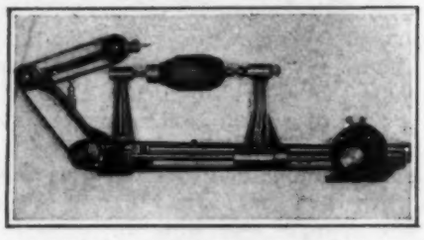
The chuck is made in 5-, 6-, 8- and 10-in. sizes.



Westcott Junior IXL Independent Lathe Chuck

Ransom & Randolph Mica Undercutter

For undercutting the mica insulation in the commutators of small armatures, the Ranson & Randolph Co., Toledo, Ohio, has recently placed on the market the undercutting machine shown in the accompanying illustration. The device is quickly adjustable to accommodate any type of small armature up to 22 in. in length and 11¾ in. in diameter.



Ransom & Randolph Mica Undercutter

The armature is held between centers so that it may be rotated by the operator's left hand, while the right hand is used to move the cutter. The bracket that forms the tailstock is adjustable along the bed and the tail center is spring-pressed. The cutter spindle is mounted at the end of a swinging arm, and is driven through belts from a motor mounted at the other end of the machine.

Waterbury Farrel Screw-Thread Rolling Machines

An improved line of reciprocating screw-thread rolling machines is now being marketed by the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Six sizes of the machine are built, having capacities for rolling threads on screw blanks up to ⅝ in. in diameter. Threaded portions up to 4 in. in length can be produced on these diameters.

A hopper feed is provided for the machine, the blanks passing from the hopper down an inclined chute to the transfer mechanism. This mechanism carries the blanks across to the entrance of the dies. The transfer mechanism and the dies lie in the same angular plane as the chute. The transfer slide has suitable fingers that pick up the blanks at the bottom

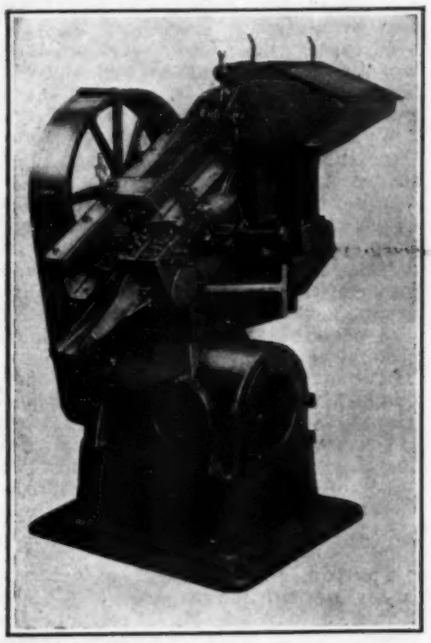


Fig. 1—Waterbury Farrel Screw-Thread Rolling Machine

of the chute and carry them across to the dies. The slide is actuated by a spring but is returned positively by means of a cam.

The dies are simply rectangular pieces of hardened steel in which the thread grooves are cut. The arrangement of the dies is illustrated in Fig. 2. One of the dies is held in a stationary block while the other is fastened to the gate. The dies can be made of various heights to accommodate the required length of thread. For short threaded lengths filler plates are placed in the die pockets to locate the dies at the proper height.

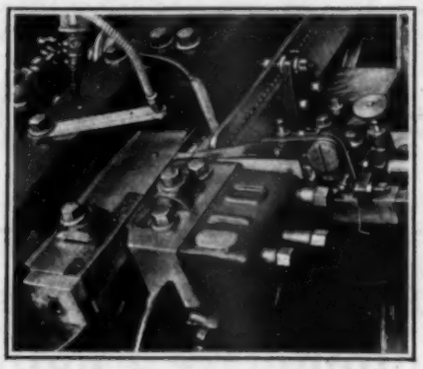


Fig. 2—Die arrangement in Waterbury Farrel thread rolling machine

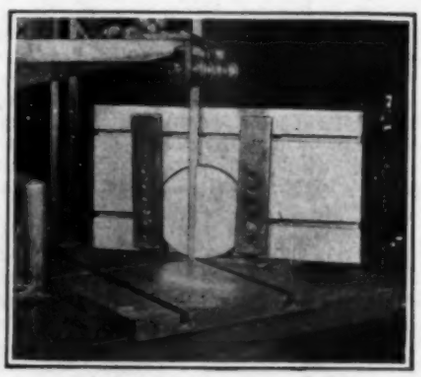
As soon as the blank has been transferred to the die opening, a spring pusher bears against the blank to assist in forcing it between the dies at the start of the downward stroke. The blank is thus pinched between the dies and the thread is rolled on its shank during the downward stroke of the gate. At the lower extremity of the stroke the threaded blank drops from the dies into a trough through which it slides to a suitable receptacle.

The machine is built for either belt or motor drive, the motor-driven unit being illustrated in Fig. 1. The production of the smallest machine is 150 blanks per min., while the largest size threads 40 blanks per min. The net weights of the different sizes range from 375 to 6,700 pounds.

Atkins Adjustable Angle-Plate for Bandsaw

E. C. Atkins & Co., Indianapolis, Ind., have recently brought out an adjustable angle-plate to be used in connection with their No. 3 metal bandsawing machine. It is intended primarily for use in tool rooms, stockrooms, steel shops, etc., where metal is to be cut at various angles.

The device consists of a base-plate



Atkins Adjustable Angle-Plate for Bandsaw

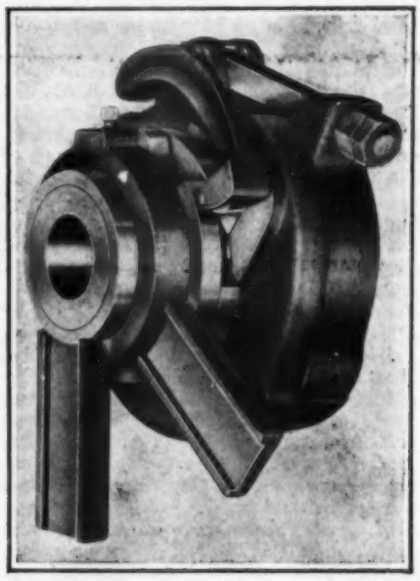
having a working surface of 12x20 in., and a 10x20-in. angle-plate, fixed in a vertical plane with relation to the base-plate but capable of being adjusted and clamped at any angle in the horizontal plane.

Slots are provided in both horizontal and vertical surfaces to accommodate standard T-head bolts.

Conway One-Revolution Clutch

A friction clutch that will make one revolution and stop when tripped is now being marketed by the Conway Clutch Co., 1956 W. Sixth St., Cincinnati, Ohio. The device is shown in the running position in the accompanying illustration.

The arm that operates the friction unit carries a cam roller at its outer



Conway One-Revolution Clutch

end. The roller contacts with two cams. Each cam has a notch in its periphery and the clutch arm moves to the stop position when the notches of the cams are together. The outer cam remains stationary and the inner one is controlled by a treadle or other mechanism. When the treadle is released the inner cam moves to the stop position, and the clutch is released at the completion of the next revolution. If the treadle is held depressed, the clutch continues to turn.

Five sizes of the clutch are made, with transmission capacities from 1 to 25 hp. at 100 r.p.m. The small clutches run at a speed exceeding 200 r.p.m., the speed of the large size being about 80 r.p.m. The shaft sizes range from 1 to 2⅛ inches.

News of the Week

Pertinent Subjects Discussed at Production Meeting of Automotive Engineers

Wages and labor, nickel plating, factory management, coining press methods, tool design, motor car lumber, and other problems debated

With headquarters at the General Motors Building in Detroit, the Society of Automotive Engineers held the annual Production Meeting on Oct. 22, 23 and 24. The attendance was not very large, but what was lacking in numbers was made up in interest and active discussion.

Probably the most interesting session was the first one, at which A. L. De Leeuw, consulting engineer and consulting editor of the *American Machinist*, and A. R. Kelso, production engineer of the Hudson Motor Car Co., were the speakers. The meeting was conducted by John Younger, associate editor of the *American Machinist*, and editor of *Automotive Abstracts*.

As Mr. De Leeuw's paper will be published in full in later issues it will be sufficient to say here that he stated that, although the automotive industry has been successful in taking care of large operations and important parts, there is still much to be done on the less important operations and parts. Dr. Schlesinger of the Charlottenburg Technical High School, Germany, described the apparatus used to test drills and drilling machines and pointed out the desirability of different clearance angles and point thicknesses for various materials. He said that no drilling machine had yet been built capable of the high drilling speeds desirable in drilling the new magnesium alloy now much in use in Germany. In response to a question by George Merryweather, Dr. Schlesinger explained the way in which his institution co-operates with industry in solving its problems. One of the few good results of the war, from the German viewpoint, is this same spirit of scientific co-operation.

Coining Press Operations

Mr. Kelso's paper on coining press operation, appears in this issue of the *American Machinist*. In reply to questions he explained that under coining press, parts like connecting rods and small levers can be held to an accuracy of 0.002 to 0.004 in. without having the dies close. When an accuracy of 0.0005 in. is required the dies must meet. For strengthening such parts as clutch disks, a percussion press would be useful if a large enough one were built. Good results have been obtained by stacking plates under a hydraulic press or by using multiple dies.

The respective limits of the knuckle joint and hydraulic presses were brought out in discussion. Mr. De Leeuw mentioned the possibility of overcoming them by operating the knuckle joint through a hydraulic cylinder and Dr. Schlesinger described briefly a type of press developed by Hury Pels and the German General Electric Co., in which a small electric motor is substituted for the flywheel to provide a flexible safety device.

J. J. Hartley of the Borg & Beck Co., Moline, Ill., told of substituting drop hammer operations for straddle-milling of clutch arm bosses. Six pieces are finished simultaneously at a cost of eight cents per hundred.

Mr. Henry's Paper

The automobile shipping session on Wednesday afternoon drew but few lsiteners. A paper by Frank Henry of the Studebaker Corp. was read by Assistant Secretary Hill. Ben Moore of Dodge Bros., had a good paper describing the methods used by his company to secure maximum concentration of loading in a freight car.

Discussion was led by Capt. Evans of the E. S. Evans Co., who told of tests to determine the effect of shunting freight cars at ten miles an hour. The necessity for adequate hold-downs was evident, also the undesirability of shipping cars on the rims.

The other Wednesday afternoon session was taken up by discussing "Wages and Labor." H. G. Perkins of the Maxwell Corp., based his paper on one given by E. K. Wennerlund of the General Motors Corp. at the first S.A.E. Production Meeting two years ago, and describes the results of an installation of the group bonus system of wage payment in the plants of his company. A spectacular increase in productive efficiency has been obtained accompanied by a marked advance in quality together with a reduction in the amount of scrap.

In this system time standards are set for a definite group operation and these are adhered to for a stated period of time. If an error has been made on the high side, the men are given warning that the rate will be cut at the expiration of the time and that they had better make all they can "while the going's good." Percentages of the bonus are calculated on a species of day-work rating; the better men having the higher day-rate. Foremen are at present paid a straight salary and the men receive all the direct wage accruing to them for a saving of time below the standard. Indolent workmen are expelled from the group by the men themselves.

Discussion developed that the Cadillac Motors, the Kelsey Wheel and the Continental Motors companies have gone over to this system almost entirely, whereas the Cleveland Motor Car, the Hudson and the Chandler companies preferred group piece-work.

The other speaker in the session was C. A. Lippincott of the Studebaker Corp. who elaborated on the failure of paternalistic welfare systems and dwelt on the best way to give a man a square deal by being just to him. He also described very briefly the bonus system of the Studebaker company, based on the years of service a man has put in at the plant. A yearly pension of 25 per cent of the man's average yearly earnings is paid to a man reaching 20 years of service and 60 years of age. A minimum of $30 a month is paid to those eligible.

"Waste Reduction"

Thursday's session was of interest in dealing with the problems of "Waste Reduction." Carl B. Auel of the Westinghouse Electric & Manufacturing Co. spoke on the broader aspects of the subject and L. A. Churgay of the Maxwell Motor Car Co. spoke more specifically on the savings to be gained in concentrating on the small tool expense. Mr. Auel's paper appears in this issue of the *American Machinist* and Mr. Churgay's will appear in a later issue.

A second session on Thursday afternoon brought out two papers on nickel plating, one by W. H. Graves, of the Packard Motor Car Co., and the other by W. M. Phillips of the General Motors Corp. Mr. Graves gave a very complete account of the new plating methods recently installed at the Packard plant. The three problems they have solved are the prevention of rusting, pitting, and peeling. Tests were set up as controls of their progress in overcoming these difficulties, the salt spray test being satisfactory to determine resistance to rust. A 24-hour test is given which is be-

lieved to be equivalent to two years of active service.

Radiator shells are polished in five operations. One with No. 70, one with No. 120, and three with No. 150 emery. They are then cleaned in an electric cleaner, dipped in cold water and in hydrochloric acid. After this comes a cyanide dip to neutralize the acid and another trip through cold water. Next comes copper plating in a moving-cathode tank where the speed is about one ft. per min., the current strength is 25 amp. per sq.ft. of surface, and the time is, 17 min. The shells are buffed, put through a second cleaning operation, and nickel plated. In the nickel bath current density is 11 amp. per sq.ft. and the time is 40 minutes. Final washing and buffing completes the process. The nickel solution is at room temperature and the copper solution at 150-160 deg. F. All solutions are controlled by the laboratory.

The first afternoon session discussed, "Tool Design," but as Mr. De Leeuw pointed out it was more a consideration of jigs and fixtures, the design of tools in the accepted sense of the word not being touched upon. Joseph Lannen of the Paige-Detroit Motor Car Co., showed the method of estimating costs for fixtures and how these were charted against the number of pieces to be done. Several alternate schemes are so charted and finally from a composite chart the decision is made as to what particular method will be used. There are some 30 tool designers in the Paige plant to some 300 toolroom men, but the fact is that these 30 men are employed mostly on maintenance tool work, and most new tools are contracted for outside the plant. The ratio of drafting cost to tool cost over two years is close to 80 per cent.

Tool Design

Paul V. Miller of the Taft-Peirce Manufacturing Co., had his paper read by an associate and dealt mainly with the fundamental problems of tool design or rather fixture design. Some criticism came up of the methods shown for fastening in the work and it seemed as if the audience preferred the cam type of fastening device rather than the bolt and nut which is too slow

Another point in the discussion centered around the problem of what to allow the toolmaker in the way of tolerances as compared to those given on the original work. Mr. De Leeuw was of the opinion that the best way in a tight fit was to tell the tool maker to do the best possible and then accommodate the work to the jig.

At the automobile lumber session, B. Nagelvoort, the Towson Body Co., discussed "Lumber Problems Encountered in Automobile Plants." H. D. Tiemann, of the Forest Products Laboratory, explained in convincing fashion exactly what happens to a piece of lumber during the various stages of the air and kiln drying processes.

The annual Production Dinner held on Thursday evening at the Statler was the best attended session of the meeting. President Henry M. Crane acted as toastmaster and the speakers were: H. H. Rice, president of the Cadillac Motor Car Co.; C. B. Auel, of the Westinghouse Electric & Manufacturing Co.; and Edwin M. Mulock, formerly the director of personal relations of the Ford Motor Car Co.

In his address, Mr. Rice said that in the old days automotive engineers were prone to throw old designs overboard and make out whole new ones when a new idea struck them. Now there is a tendency to follow the beaten track as is evidenced by the similarity of the designs of different makers. He insisted that the engineer must be more forward looking, that "let well enough alone" is a cowardly policy for him, although it may be all right for the general manager.

Future Designing

In referring to the modern trend in automobile design, Mr. Rice gave it as his opinion that in a very few years the possession of a large open car would be the distinguishing mark of a man of wealth. Others would use all-purpose cars. He quoted C. F. Kettering as saying that there would be more developments in automobile design during the next five years than there has been in the last ten.

Mr. Auel deplored the almost complete lack of standardization in American manufacturing and prophesied that the next generation would receive from us a poor man's legacy unless steps are taken to stop this form of industrial waste. He also commented on the terrific economic waste occasioned through fatal industrial accident. Continuing along the same lines he compared the wages paid in Germany and in other European countries for doing a certain piece of work with those paid in this country and said that any foreign manufacturer could come over here, pick out any one of our industries and go home and take the market from us even though we doubled our duties. To prove his contention he mentioned the capture of the Easter novelty trade by Germans. Going further he said that more recently Japan has taken this trade from Germany and the Christmas tree ornament business as well.

The final speaker, Mr. Mulock, spoke of human relations. Men cannot be molded to our desires as are automobiles and other machines. Our task is rather to learn to understand men as individuals and in the mass.

The Ford plan was successful because workmen were given the eight-hour day before they demanded it and no corresponding increase in hourly output was demanded.

In conclusion he expressed his belief in Whiting Williams' conviction that the fear of unemployment is the governing motive in the workman's industrial life.

The Friday morning session was devoted to "Factory Maintenance Problems." L. A. Blackburn, plant engineer of the Olds Motor Works, and E. E. Remington, plant engineer of the Ford Motor Co., being the speakers. Mr. Blackburn detailed the scope of the plant engineer, pointing out how his activities reached from mechanical engineering through electrical engineering to civil engineering and again to transportation engineering, and even to the practical working out of very human problems, in connection with traffic, fire prevention and safety measures. He pointed out the importance of the power plant superintendent—a one per cent saving in this department alone on a plant of 2,000 hp. is enough to pay the salary of a high grade combustion engineer. Savings in turning off the heat a half an hour before stopping, and on again half an hour before starting are perfectly feasible and more economical than leaving the heat on all night. The temperature should not drop below 40 deg. F. however.

The Olds plant has a record of 800 electric motors in operation with only three burn-outs per month. On this question it was stated that motors should be chosen to fit the particular job they have to do and should be no larger than necessary. The same is true of belts. Nothing is gained in maintenance work that would compensate for the increased capital cost. Considerable discussion was given to this phase of the question and it was evident that the most important problem the plant engineer has to face is belting.

Mr. Blackburn's system called for the safety director to be under the plant engineer and there was considerable questioning on this. The safety man instructs the operators directly as to the proper handling of the machines from a safety point of view and also has charge of the first aid system and the hospital.

One interesting thing in the Ford plant is the standardization of such equipment as hangers, shafting, pulleys and belting. There is also a standardization of methods used to effect repairs. Mention of special lifting machines used by the millwrights to place shafting and pulleys in place brought out the fact that standard 2x8-in. planks of white pine free from knots are used throughout the department. Although 9,200 machines had been moved up to Oct. 23 of this year only eight were broken by reason of moving.

The Pipe Fitter's Outfit

Another interesting piece of equipment capable of use in other shops is the pipe fitters' wheeled bench filled with the tools and parts he wants for a particular job. This saves endless trips to and from the stores. A small belt-cutting machine costing a few dollars enabled belts to be cut off direct to the desired length with a saving of $22 per day in the odd lengths no longer cut off.

The Ford plants are patrolled every six minutes. Mr. Remington believes one hour is altogether too long to allow a fire to gain headway in. Incidentally no smoking is allowed in the Ford plants on any pretext whatever.

Exhibits in connection with the meeting consisted of the bench type Hartness screwthread "Comparator" shown by the Jones & Lamson Machine Co., and three grinding machines under power shown by the Motch & Merryweather Machinery Co. They were a Giddings & Lewis "Teromatic," an 8x18 Cincinnati cylindrical grinder and a Cincinnati centerless grinder. Harry Beal and W. H. Beardsley were in attendance at the Jones & Lamson exhibit and Messrs. Merryweather, Wood Walter, Ormsby, Tangeman, Peaslee and Bayliss at the grinding machine demonstration.

Eastern Chamber of Commerce Meeting Hears Coolidge

Stanley Bullard proposed as member of board of directors

That this country is co-operating and will continue to co-operate with European countries, and that this country stands ready to participate in international conference, but objects to bringing its domestic affairs into international conferences, were the declarations made by President Coolidge before the Eastern meeting of the Chamber of Commerce of the United States held at Washington, D. C., Oct. 23 and 24.

President Coolidge explained carefully the government's position on foreign affairs and declared his opposition to any cancellation of European debts. He stated that any further tax reduction was impossible. He outlined his idea of the fallacies of government ownership and also the error in proposing to make the Supreme Court subservient to Congress.

The audience which listened to the President was made up of business men from the Eastern portion of the United States including the New England States, New York, New Jersey and those on the Southern seacoast.

The two day meeting held by the Chamber this year in the East was an unqualified success. Speakers of prominence occupied the first day's sessions while the second day was given over to reports of committee and group discussions.

The opening session of the meeting was given over to an informal discussion of "The Chamber of Commerce of the United States as an Aid to Business." The managers of the eight representative departments of the National Chamber which include Foreign Commerce, Finance, Natural Resources, Domestic Distribution, Transportation and Communication, Civic Development, Manufacture, and Insurance, discussed the work of these departments, their future program and how the resources of the department can be made of greater service to business. Delegates to the meeting joined in this discussion and also presented their own problems for open debate by those present.

Following luncheon the meeting divided into sections with Willis H. Booth, president of the International Chamber of Commerce, John H. Fahey, chairman of the Foreign Affairs Committee of the National Chamber, Frederick H. Ecker, vice-president of the Metropolitan Life Insurance Co., Herbert Bayard Swope, executive editor of the New York World, and others as speakers and discussion leaders.

Lewis E. Pierson, vice-president of the Chamber of Commerce of the United States, presided at an informal dinner and Richard F. Grant, president of the chamber, was the chief speaker.

A cablegram from Owen D. Young, Agent General of Reparations, was read by A. C. Bedford. Mr. Young told with what ease the Dawes plan had been put into operation and the good that was already resulting from the plan.

The names of the following men for directors were placed before the meeting and will be voted upon at the next annual meeting of the Chamber in Washington in the Spring:

Stanley H. Bullard, vice-president of the Bullard Machine Tool Co., Bridgeport, Conn.; A. L. Humphrey, president of the Westinghouse Air Brake Co., Pittsburgh; E. C. Graham, president of the National Electrical Supply Co., Washington, D. C.; John W. Arlington, president of the Union Bleachery, Greenville, S. C.; Noble Foster Hoggson, president of Hoggson Bros., New York City; A. J. Brosseau, president of Mack Trucks, Inc., New York City; Harry A. Smith, president of the National Fire Insurance Co., Hartford, Conn.; and Milton E. Marcuse, president of the Bedford Pulp & Paper Co., Richmond, Va.

Resolutions on the following subjects were adopted: Waste in Business, Expenses in Government, Public Utilities, and a résumé of the Second Divisional Meeting.

Cleveland High School Tool List

The Board of Education, Rockwell and East 6th Sts., Cleveland, Ohio, will receive bids until Nov. 10, for machinery for the Collinwood Senior High School, as follows:

Elementary Pattern Shop No. 26—six 12x20-in. wood turning lathes; one oil stone grinder one 18 in. band saw complete with stand-Oliver; one 6-A Universal Fox bench trimmer; Universal bench saw complete-Wallace; one 6-in. bench jointer complete with stand-American; one disk sander.

Advanced Pattern Shop No. 27—Six 12x20-in. wood turning lathes; one 16x60-in. wood turning lathe; one oil stone grinder; one 30-in. band saw; one 6-in. jointer-American; one disk sander, one 6-E Fox trimmer.

Art Metal Room No. 8—One D. L. A. grinding and buffing motor-Robbins & Myers; and one electric grinder for battery room No. 7.

Machine Shop No. 44—Two 2-wheel bench grinders; one sensitive drill press; two anvils and bases; ten 13 in. x 5 ft. lathes; four 13 in. x 5 ft. lathes with taper attachments; one 13 in. x 5 ft. lathe with full tool room equipment; seven 13 in. x 5 ft. lathes with semi-quick change gear mechanism, etc.-Willard; one extension bed gap lathe; one 16-in. crank shaper; one 16-in. back geared shaper; one arbor press; one 20 in. wheel and lever feed drill press; one high-speed metal saw; one 9 in. x 3 ft. bench lathe; one 14-in. U. S. sensitive floor drill; one Universal shaper; one universal milling machine; one 24-in. x 6-ft. metal planer; one LeBlond No. 1 tool and cutter grinding machine; one universal tool grinding machine, counter shaft drive; one triple purpose furnace-Stewart; one No. 3 abraisive surface grinding machine; one constant speed drive back geared plain miller; one No. 2 turret lathe-Warner & Swasey.

Junior Wood Shop No. 122 — one bench saw, one bench jointer.

"Bankruptcy Prevention" Week Needed Du Brul Tells Audience

Management Week observed in many parts of the country

That a "Bankruptcy Prevention" week was needed more than a Fire Prevention Week, and that whereas close to a half a billion dollars was lost each year by fire destruction, over three-fourths of a billion was lost through bad business management, were the two startling points brought out by Ernest F. Du Brul, general manager of the National Machine Tool Builders' Association, in his speech made at the New York Management Week Meeting held Tuesday evening, Oct. 21 in the auditorium of the Engineering Societies Building, New York.

Mr. Du Brul pointed out that the war on financial waste was a vital issue and that management week was a good start toward impressing business men of the necessity of more closely studying their own affairs. He explained how business cycles were important in the regulation of production and that machine tool builders who were following the business cycle chart were finding that they were not left with heavy inventories when the quiet periods of the year came and that they were producing sufficient amounts when business was good.

The meeting held Tuesday evening was one of several held in and around the Metropolitan district. It was presided over by George E. Roberts, vice president of the National City Bank and an authority on economics. The other speaker of the evening was John H. Williams, management engineer of New York, who was formerly New York manager for Day & Zimmermann, Inc.

Meetings were held at Yonkers, Hoboken, White Plains, the Bronx, and also in the downtown New York district. Prominent among the speakers at these meetings were Horace G. Crockett, A. N. Doe and L. P. Alford.

Southern Buys Equipment

Authority has been granted by the Interstate Commerce Commission to the Southern Railway Co. to assume obligation for $7,050,000 equipment trust certificates to apply on the purchase of the following equipment: 25 heavy Mikado engines, $1,297,500; 15 heavy Pacific engines, $778,500; 10 switch engines, $345,500; 25 passenger coaches, $495,000; 10 baggage-express cars, $131,000; 6 dining cars, $249,600; 3,300 box cars, $4,800,000; 250 stock cars, $401,250; 250 flat cars, $345,000.

Our Future Competitor—Germany

How the machinery and machine tool markets of the world will be influenced by Germany's re-entrance—Financing exports—meeting the price arguments

By W. H. Rastall
Chief of the Industrial Machinery Division
Department of Commerce

(Editor's Note: The following article gives some impressions obtained by Mr. Rastall on a hurried trip just made through ten of the countries of Southwestern Europe.)

AS A BUYER of American industrial machinery, Germany, under the Dawes arrangement, takes on new interest. It will be remembered that, although our exports of such machinery to Germany in recent years have not been heavy, the trade in former years was very large, reaching a total of $5,259,000 in 1913 when Germany ranked third among all of the markets in the world, only Canada and the United Kingdom enjoying a larger trade, while for metal working machinery Germany ranked first, the total being $2,280,000 on the average for five pre-war years.

During and since the war the need for this machinery has continued, but circumstances have prevented business from materializing. Under war conditions the blockade and embargoes made it impossible to make deliveries, while more recently exchange and other complications have made business very difficult. As contrasted with 1913 total, our shipments in 1923 were only $764,000, of which metal working machinery represented only $210,000. In 1922 only $77,000 was spent by Germany for metal working machinery. For practically a decade Germany has failed to import American machinery in the way it was done in pre-war days.

Along American Lines

To a certain degree the shortage of high-class equipment represented by these figures has been met by German manufacturers who have taken up the production of machinery of the types formerly imported from America, in many instances even "flattering" American producers by copying their designs. But it should not be inferred that the need for American equipment has been wiped out as it appears to be agreed by those in the trade that not only are there many classes of American machinery that are not yet produced in Europe, thereby providing American producers with valuable opportunities, but even in the lines produced on both sides of the Atlantic, the European manufacturers can not yet equal the best American equipment. As a consequence, the industries of Germany have developed a long standing shortage of equipment of the best quality.

This statement may seem to contradict other reports that have been received regarding the superior condition of the factories of Germany, for it is undoubtedly true that one of the effects of the decline of the mark was to stimulate the construction and extension of factories in Germany, but reports indicate that these new plants are deficient in the high class equipment that was formerly imported for such purposes and one hears of orders for high class machinery being placed in America, inquiries are in the market and specialists are being sent to this country to study what is available here and to buy what is needed. To the extent that the Dawes' arrangement is successful in re-establishing German industry, it should also create a demand for high class American machinery as needed for those industries.

The following returns cover the imports of machinery into Germany:

Average Monthly Imports of Machinery into Germany in Metric Tons

1910	5,755
1911	6,344
1912	6,495
1913	6,840
1922	894
1923	457
1924, January	440
1924, February	418
1924, March	500
1924, April	555
1924, May	890
1924, June	1,290
1924, July	1,279

(These figures exclude the occupied territory.)

As a competitor in the machinery markets of the world, Germany has also developed new interest. Her pre-war export trade was large and flourishing, but the war reduced it to practically zero. In some circles it had been felt that it would revive promptly following the Armistice, but it now appears that even with great effort and the advantages accruing from the decline of the mark it has never been regained and since 1922 has been perhaps only half of the pre-war volume.

Average Monthly Exports of Machinery from Germany in Metric Tons

1910	33,400
1911	38,800
1912	44,800
1913	48,000
1922	40,900
1923	25,900
1924, January	19,700
1924, February	19,900
1924, March	19,700
1924, April	20,200
1924, May	21,900
1924, June	20,800
1924, July	25,153
1924, August	25,422

Whatever may be the causes, it is clear that for 1924, Germany is exporting less than half the volume of machinery it shipped in 1913. The old markets that were lost during the war have not been regained in spite of the fact that exports from the United States increased from $88,000,000 in 1913 to $123,500,000 in 1923. Clearly German manufacturers are experiencing great difficulty in cultivating foreign markets and American manufacturers are justified in correspondingly strengthening their export efforts.

During recent months certain peculiarities of the German situation have, in large measure, been cleared up and American exporters can now look to the future with greater confidence. Among these is the price situation. A few months ago reports were frequently received of instances where German quotations were a mere fraction of the American level. In exceptional cases more reports of this character may be received. But, generally speaking, it seems to be clearly established that German costs are now above world market levels, and in cases where machinery has to be built after order, the prices will probably be in line with or above quotations from other countries. On the other hand, money is very tight in Germany, and in cases where manufacturers are still carrying stocks produced when the mark was low, depressed quotations may be expected.

For a time it appeared that German manufacturers had been able to eliminate their overhead charges through the decline of the mark and would be able to quote corresponding prices. This has, at least in part, been overcome by the Dawes' arrangement by which German industry is bonded in gold to meet reparations payments. It is difficult to estimate the practical effect of this burden, which for the machinery industry is 17 per cent of the income tax for 1924 and the full interest charges will not be collectable sooner than 1928.

Advantages Eliminated

In earlier postwar years, German exporters enjoyed special advantages because of special railway rates, broad subsidies and through banking facilities that enabled them to quote liberal terms of payment. These advantages have now largely been eliminated. The railways are to be self supporting, while on the financial side interest rates are so high as to make discounting impracticable and German exporters are now most anxious to secure prompt payment in most instances. As a result, Americans in foreign trade find their competitors operate on more businesslike lines than has sometimes been the case and foreign business is correspondingly more attractive. These developments have now reached the point where German manufacturers are complaining that higher freight rates, higher taxation, bad financial conditions, etc., make it difficult for them to export successfully, and claiming that manufacturers in America and England are in a position to grant credits of three to five years now demand banking facilities that will make it possible for them to do likewise.

Henry R. Towne Leaves Vast Fortune for Museum of Peaceful Arts

United Engineering Society and Franklin Institute benefit

The will of Henry R. Towne, engineer and head of the Yale & Towne Manufacturing Co., filed for probate recently, disposes of an estate estimated at several millions and gives the bulk of it as a residuary bequest after the death of his son, John Henry Towne, to establish museums of peaceful arts, or industrial museums for the people of the City of New York. He gave $50,000 for "a campaign of education, news and publicity designed to bring prominently to public notice essential facts concerning the great industrial museums of Europe." The will urges support of the movement by the members of the Merchants' Association, of which he was a former president, and other interested citizens and asks that a committee be selected to go to Europe to obtain data regarding such institutions for use in the campaign.

Another $50,000 fund, to be known as the "Henry R. Towne Engineering Fund," goes to the United Engineering Society of 33 West Thirty-ninth St.; New York University receives $10,000, to go into their endowment under the name of the benefactor.

The Franklin Institute of Philadelphia gets $10,000 in trust as a fund in memory of Mr. Towne's father, the late John Henry Towne, who was actively connected with the institute.

"To impress upon the public the importance and value placed by me in such museums," the decedent calls attention to the fact that "the United States is the greatest industrial nation in the world, and we have many magnificent museums of ancient and modern art. We do not possess any permanent exposition of American achievement in the peaceful arts, including agriculture, animal industry, forestry and woodworking, mining and metallurgy, transportation and communication, engineering and architecture, industrial chemistry, electrical mechanisms, aeronautics, textiles, building trades, and all of these, including products, processes and implements."

Latitude is given the executors and trustees in handling this fund, and the judgment in the expenditure of funds must be unanimous. They are: John Henry Towne, Robert Struthers, Jr., and the Bankers' Trust Co. of New York. If it is deemed inexpedient by the executors and trustees, by unanimous judgment, to expend funds for peace museums, the residuary estate is to be divided into two equal parts for the benefit of the Metropolitan Museum of Art and the American Museum of Natural History, both located in New York City.

Provision is also made in the will for the erection of a "service building" for the benefit of employees of the Yale & Towne Co. Six thousand shares of the capital stock of the company, valued at $150,000, are placed in trust of a committee.

Willis H. Booth Outlines Our Position in World Markets

Tells exporters the duties that we must perform

Willis H. Booth, vice-president of the Guaranty Trust Co. and President of the International Chamber of Commerce, outlined at the fifteenth annual convention of the American Manufacturers Export Association at the Hotel Commodore, Oct. 22 what in his view was necessary for the improvement of world business conditions. Mr. Booth said that the main factors were the immediate settlement of the amount Germany must pay in reparations, the allocation of amounts among the creditor nations and the adjustments of payments from the currency of debtor countries to the Allies.

No general rehabilitation in Europe is possible on the basis of the insolvency of another nation, he said. Germany must come back economically, and in order to do that she must export a greater volume of goods than before the war.

"We are going to face a competitive situation, but there will be more business all over the world, and even with German expansion in the export field there will be enough for us and for all nations. Only by the interrelated prosperity of all countries can we succeed. We would welcome the rehabilitation of Russia, which will eventually come. Australia is developing faster than she ever has in her history, and Africa is going to be a center of economic and commercial development as great, perhaps, as North America has been. When China settles her present difficulties there will be plenty of business there. It is going to be a forty or fifty year job, but America will get her share of the new business."

W. W. Nichols, of the Allis-Chalmers Manufacturing Co., who was re-elected president of the association, discussed the visit to Mexico in September of a mission of sixty-seven American business men whose purpose was to promote better understanding between the two nations. The tendency on the part of some Americans to condemn Mexico was due, he declared, to ignorance of the conditions there.

Edward Prizer, chairman of the board of the Vacuum Oil Co., said there was widespread hostility to the United States abroad, due partly to envy at our remarkable development. His organization, he said, had adopted the policy of allowing any dissatisfied customer to return goods if he desired, with the result that practically nothing was returned. He said his company had found it advantageous to employ native salesmen in each foreign country where it did business.

Other speakers were E. D. Kilburn, vice-president of the Westinghouse Electric International Co.; Colonel Fred Cardway, international distributor of automobiles; Paul R. Mahoney, who sells office appliances abroad; E. D. Watts, exporter of industrial machinery; and C. A. Richards, a specialty exporter.

Mr. Watts stated that industrial machinery exporting depends entirely on full and satisfactory service through the entire transaction.

The officers were re-elected, except that W. W. Mitchell was named as a vice-president to succeed William Pigott, and Louis S. Brady was elected treasurer in place of Julian W. Potter.

Better Times Ahead Says Conference Board

Everything points to a slow but steady improvement in industry, says the National Industrial Conference Board. The latest survey of wages, hours and employment in twenty-three leading manufacturing industries, covering the month of August, shows a definite upward tendency in the number employed and in the average of hours of work per wage earner.

The rapid curtailment of industrial and business operations in the spring, together with the cautious hand-to-mouth buying for immediate needs through the summer has apparently decreased inventories to that point where public needs for consumption are producing better conditions.

Employment from July to August stood at 71 per cent of the number employed in June, 1920, but, as the board points out, comparisons of present conditions with those of a boom period are often misleading and the present conditions reflect a fair course of normal progress. Employment is at least 5 per cent higher than it was in 1914. Further evidence of improvement is shown in an increase of nearly one-half hour in the average week worked per wage earner and of more than an hour in the average hours of plant operation from July to August.

It is a remarkable fact that in spite of an industrial depression of some severity, with very few exceptions, wage rates have maintained the high levels which were reached in the boom period of last year. Although average hourly earnings of all wage earners dropped 3 cents in August over July, they still remain 127 per cent above the level of July, 1914, and not far from the level of a year ago.

Will Exhibit ZR-3 Motor

The motors that brought the ZR-3 safely across the Atlantic Ocean were made by the Maybach Works which has a representative in New York. A spare motor of the same design is to be exhibited at the Automobile Salon that will be held at the Commodore Hotel Nov. 9.

French Industries and the Dawes Plan

France awaits the German competition about to be created—Development of machinery building to overcome international dependence

By Our Paris Correspondent

THE impending German loan in conformity with the Dawes' plan has brought about a momentary slowing down of business in France. Notably the metal trades have been affected owing to the putting into application of the Franco-German coal and iron ore accord. France has the latter and Germany the former. Each country has economic need of the other in these two respective commodities. Such an arrangement was bound to come sooner or later and the moment that it gets in full swing, Germany's position in the export of metal manufactures will become immeasurably fortified.

American capital in French industries would be welcome, indeed is being sought, by many French firms and in many quarters and under many guises. French railways and electrical industries have already profited. Fresh issues of industrial stocks and bonds have virtually to look only to the American investor for their absorption. Many French companies are organized on the basis of a nominal capital anticipating expansion only when further capital becomes available.

A curious economic anomaly is shown by the issuance of the last balance sheet of the Bank of France which indicates a profit for the nine months of 1924 in excess of that of the same period in 1923 by 73,000,000 francs, almost double the profits of the twelve months operations of the previous year. Some one has profited by a situation which is manifestly not brilliant nor even stable. Again, the seven great trunk railroads show an excess of receipts of 800,000,000 francs for the eight months operation of 1924 as compared with 1923. They doubtless need the money for the renewal of machinery, equipment, rolling stock and motive power as well as for the pursuance of the electrification schemes in progress. It is very evident that they do as one who travels in the country, even if he is but a cursory observer, well knows. The Eastern Railway has 10,000 freight cars in the repair shops, and in spite of the universal eight-hour law, these shops are working a nine-hour day.

Tax Fluctuation

Tax collections exceeded two and a half billion francs in July, but fell to a billion in August. The situation is mercurial.

The financial results of the Ruhr occupation, now at its virtual end, resulted in Belgium receiving a priority of 900,000,000 francs and an additional 18,400,000 francs for the expenses of its army of occupation, with 92,000,000 francs for France on the same score, while deliveries in kind amounted to over a billion francs. Eliminating the last item, which would have come through in one form or another to a probable like amount, it is difficult to see where the venture has greatly profited France.

French exports for the first six months of the year to Great Britain increased a billion francs and to the United States four hundred million francs. Imports fell off in the first instance two hundred million francs and in the latter increased eight hundred million francs. German exports to France for the same period were reduced 66 per cent and imports from France increased 400 per cent. In general French imports rose from 13,360,-128,000 francs to 17,869,043,000 francs, and exports increased from 12,310,-695,000 francs to 18,907,049,000 francs.

No Revival Yet

The metal market itself, at the end of September, does not find the autumn revival looked for as yet above the horizon. Raw material prices are low and the bottom may not have been reached, whereas the upward tendency is recorded as already to be remarked in Belgium and Luxembourg. If a trade revival is not immediate there will be a fall in production and in consequence in stocks on hand which will later slow down all metal fabricators and transformers as well as consumers in the machine and tool trades. Not before the end of October or the first of November are prospects likely to define themselves with precision.

The general index figure of costs has advanced from 331 for the third quarter of 1923 to 366 for the same period of 1924, while foodstuffs have risen from 333 to 376. This shows that industry and the wage earner alike are visibly worse off in a certain sense than they were a year ago. The future may be anticipated as being possibly more rosy, but it is difficult to make the idea penetrate the conception of the generality of the French public, the wage earner and the general consumer above all.

There has been some improvement in the index since the first of the year, but not in the big industrial centres and in all cases it has fluctuated and in general upward.

Alsace-Lorraine industries are disturbed over the outcome of Franco-German relations which may result in higher duties being levied by Germany for the product of Alsace than were current under the accord which immediately followed the armistice. It is a fact curious of note that French automobile exporting to Germany has increased greatly during the last three years, but this may be put down to the dulness of the German auto industry.

Given the exceedingly difficult economic situation, the French machine tool trade is making exceptional progress. In an effort to compete with American and German product of big dimensions several French firms have already entered the field with success in the home market, if not abroad. The French industry is making effort to destroy what it still considers a legend that the country is dependant in any measure upon the foreigner for its machine tools. The statement is sweeping, but it is a good enough slogan to make a target.

There is still some protest by manufacturers in interior France by reason of the bulk of imports allowed to be brought in from the Saar under special régime.

The falling off in the present year shows the activity of the French manufacturer in meeting the situation, but he still demands a protection which he claims has hitherto been denied him.

Another notable advance is in the production of French agricultural machinery and tools. This should be a matter of prime moment to the American manufacturer. It is probable that the use of farm machinery and tools in France will become greater before it becomes less, hence the market saturation point is still believed to be a long way off.

Certain French manufacturers are said to have already an over-production which they look to the foreign market to absorb. The total French output is estimated at a value of 400,000,000 francs per annum. Imports of agricultural machinery were valued at 50,000,-000 francs in 1913; 200,000,000 francs in 1920; falling to 130,000,000 francs in 1923.

Strides in Milling Machinery

Milling machinery was hitherto chiefly supplied by Germany, Austria and Switzerland. France today has thirty different firms producing such, employing 6,000 workmen, with an output valued at 100,000,000 francs per annum.

Sugar refining machinery of French manufacture is exported to Central and South America. Chemical appliances and machinery occupies 20,000 workmen, showing once again the growth that France has taken upon itself in certain special lines since the war, thus replacing in no small measure her hitherto dependency upon other countries.

Outside of the Paris district and in regions where there may be a strictly localized industry, as the small hardware and stamping of metal of the Ardennes, the metal industries of the Lyons region in mid-France, according to statistics of the Chamber of Commerce there, shows the most notable activity at the moment. Here the iron, steel, bronze, aluminum, foundry, finishing and wire drawing industries and the like did a volume of business in 1923 which reached 664,186,000 francs, as against 505,452,366 francs ni 1923.

The Business Barometer

This week's outlet in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

THE business cross-currents which appeared in last week's reports were all traceable to the elections. The main stream is flowing at a slightly accelerated speed. Production of basic and manufactured commodities is gaining somewhat and employment is increasing. Money is still "dirt cheap." The turnover of goods measured by car loadings and bank clearings is close to a record. The figures are published as they are compiled and most business men read them.

Nevertheless there is a distinct disappointment that business is no better and a marked hesitance to undertake new enterprise. In the manufacturing districts, such as New England, retail trade has not kept pace with greater industrial activity. In the West the farmers are receiving the highest prices in three years for their grain and their hogs, but they have not yet begun to buy to the extent anticipated, preferring to pay their debts and indulge for a while in the luxury of having money in the bank. The invitation of low interest rates to expansion or speculation is still generally ignored.

No one can doubt this lethargy and lack of resilience that characterize the markets are due to uncertainty as to the outcome of the elections.

While admitting that their own business is better, many men express in the same breath a cautious fear of La Follette which must be reckoned with for the next two weeks, since nothing will remove it but the result of the balloting itself. Some, however, are ridding themselves of the idea. Col. Ayres of the Cleveland Trust Co., has delved in the records and demonstrated factually what well informed people already know; that political affairs have always been subordinate to economic causes in determining the course of business and that the years of prosperity and depression in our history have been divided about equally between administrations of the two chief parties.

Furthermore, no responsible observer concedes La Follette the slightest chance of election and very little of throwing the election into the House; and if the latter contingency should occur there is not much doubt that either Coolidge or Davis would be elected, for the possibility of the Senate being allowed to choose between Bryan or Dawes is kept alive more to fill columns in the Sunday newspapers than by any real likelihood that it will occur. And even if the La Follette adherents should increase their power in Congress, business would be more scared than hurt. The third party could not amend the Constitution itself, its legislative accomplishments over the President's veto would be negligible, and it could not block executive recommendations any more effectively than it did in the last Congress.

Meanwhile the American people would still need and be able to buy food, clothing, shelter and the multitude of semi-luxuries which they cannot now do without, and since by general report there are no accumulated stocks to supply them a major business recession is unthinkable.

There is not yet an entirely general acceptance of these facts, but those who are really entitled to call themselves leaders are recovering from the prevalent neurosis and the advance in the stock market last week was probably a direct discounting of the election of Mr. Coolidge and a steady improvement of business throughout the autumn.

The iron and steel journals all say that the election is a positive though sentimental factor in those markets, but even while consumers are keeping their stocks down they are buying steadily on a hand-to-mouth basis and with the addition of heavy railroad purchases the volume of orders is fairly satisfactory.

A cut in tire prices despite the advance in rubber is a welcome gift to 15,000,000 automobile owners. Most raw materials are firm and little reason appears anywhere to put off purchases through expectation of lower prices, though pig iron may go lower, grains seem high enough and coffee is so much the football of Brazil that none can tell what may happen to it. Sugar is unchanged despite the scarcity of presently available supplies, for lower spot prices to come are already discounted in the futures markets.

A sign of the times is that coal is selling better at firm prices. There are numerous indications that the oil markets are about at bottom. The latest report of car loadings showed them close to the high record of all time. The statement of the Federal Reserve Banks takes on less and less significance as bills discounted decline, but a gain of two per cent in the reserve ratio last week emphasizes the plethora of credit and the absorption of the German loan had no effect either on money rates or prices of sound bonds. Some of our government issues made new highs. Contrary to the belief of some we are still a net importer of gold, although the flow to this country will necessarily be relaxed if we lend as much abroad this autumn as now appears likely.

More fundamental than political uncertainty in its bearing on business will be the effect of high prices in causing consumers to continue their hand-to-mouth buying and of foreign competition in compelling our manufacturers to keep costs down. But about the most they can do will be to hold the autumn improvement within healthy bounds.

What's Doing in Industry

Better buying of equipment by the railroads was reflected in the machinery and machine tool markets this week when inquiries and orders were received from the car builders, locomotive makers and the railroads themselves. But business is still behind expectations and machine tool dealers in all parts of the country are awaiting patiently until after Nov. 4, when they are confident an improvement will be experienced.

The month of October proved to be only fair as compared with normal months. Railroads bought only necessities, the automobile builders were not in the market to any marked degree, the big electric companies bought sparingly and general industrials were the only source that seemed to be willing to buy. Light machine tools were sold to radio receiving set makers and foundry equipment was inquired for and purchased in the Eastern markets.

Wall Street strengthened slightly during the week as compared with the week previous, but the volume of sales was still off and sellers were cautious, except speculators who traded on rumors and straw votes. Railroads remained fairly strong on talk of further consolidations and some automobile shares held against bear attacks.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Philadelphia

An improvement in the business tone prevailed in the industrial establishments of Philadelphia this week, with indications that there will be a general trend toward improvement during the next few weeks. This was particularly noticeable among the larger producers of machinery and machine tools, who saw in the present situation the prospects of Eastern railroads entering the market with substantial lists early in November.

There was nothing in the situation to forecast a boom in this district, but conditions generally indicate a favorable underlying situation.

The same prevails among dealers in small tools and various kinds of machinery. Used machinery is in better demand now than it has been for several months, and inquiries from purchasers of small tools have been received which indicates the larger purchasers soon are to enter the market with good-sized lists. Some of the Southern railroads are preparing lists for early purchase of used goods, the dealers are informed.

In the last few weeks many of the smaller dealers have done an active business in small orders among the moderate purchasers, and inquiries seem to indicate business will continue to improve. Shapers have been moving better in the last few weeks than heretofore. Prices are keeping up well and collections are fair.

Cincinnati

There is a slightly better feeling apparent in the Cincinnati machine tool market. Inquiries have increased to some extent and manufacturers are of the opinion that business should be fairly good during the last few months of 1924. The optimistic tone to the local market has not been produced by the actual orders that have been received lately, for these are of about the same volume as prevailed during September and August. Plants are, in most cases, still operating on a reduced schedule that calls for curtailment in production. This schedule approximates forty to sixty per cent of normal capacity. Several of the larger machine tool houses are still running on a big scale and are working on orders for special machinery. These larger companies are now operating on a more satisfactory basis than at any previous time this year.

In fact inquiry among the manufacturers reveals that most of the machine tool plants in Cincinnati are in better condition today than they have been for a number of months. Business is rather spotty in character, however, for some of the companies state that they are well satisfied with the results they are getting at present while others report that they find business is rather quiet.

There has been some call for machinery by railroads in the past two weeks. Lists have not been large, however, and the outlook for the immediate future is for a lull in railroad buying temporarily. The automobile manufacturers have been making a fair number of purchases of tools, but the volume, on the whole, is small. Lathes have been produced in fair numbers. Milling machines have increased in demand lately. Drilling machinery is quiet at present, but there are several fair sales reported. Woodworking machinery production goes ahead at a normal pace. Electrical tools are being turned out in goodly numbers, a large portion of them going to the automotive field. Tobacco machinery companies state that their sales have been only fair lately. There has been an increase in the production of foundries during October and this month will show a better production record probably than any month since last spring.

Cleveland

In reviewing the results obtained during October, machinery manufacturing and distributing interests in the Cleveland district find that practically all the effort expended during the early part of the year has been concentrated in returns during the month just closing. In short, general manufacturing, specialty production and machine shop activities appear to have been held off until virtually the last minute before entering the market. Hence, with few exceptions, more business has been done in certain quarters during the last few weeks than during any four months throughout the year.

Outstanding features of the inquiry now coming in are the better interest manifested by the boiler making, structural steel manufacturing, automobile parts, and diversified metal working operators. Not all of this is inquiry, either, a good many orders for various types of equipment having been placed during the fortnight. In the shear and punch division a good deal of new business has been placed for medium sized equipment by boiler manufacturers and by structural shapes makers. Both of these activities appear to reflect a preparation for a good building demand next spring, and probably through the winter as large construction will not be held up if the appropriations are available.

Some of the best business for automatic equipment now is coming forward from the automotive and allied trades. Here again anticipation for next spring's motor car and truck business is evidenced. Bearing manufacturers have been heavier purchasers of automatics in the last few weeks, which is considered a good barometer. This is in addition to the improvement in general manufacturing requiring these types of machines.

With the lessening of contract work in general machine shops in this district, and an improved outlet for metal working product, the planer division shows like improvement. This is noted more particularly in the Middle West, leaders in this branch assert. Both new and old shops are in the market, and it is equally significant that where only one machine was required a few months ago, several of the same capacity are being called for.

New England

Based principally on conclusions from observations by freight officials in Hartford, New Haven, Bridgeport and New Britain in the absence of segregated statistics the statement is made that machinery shipments from those centers during the past two weeks have been of increasing volume. This is confirmatory of previously given statements of better business tone. The increases in freight loadings ranged from four to fifteen cars, with the heaviest increase reported in Bridgeport.

Production requisitions are being scaled upward. Automatic machine manufacturers have ordered increased production, most of which is based on replacement orders emanating from the automotive field. Buying for the automobile industry was fairly heavy last week. Only a small amount of it was for expansions. The tone of the inquiries, however, was indicative of a satisfactory volume of prospective expansion business. Inquiries came principally from Michigan.

Hand tool trade was better during the past week. This class of buying went into the Southern market. There was also a good percentage for the middle west.

Castings business showed a slight improvement, but there is a disposition to order only for immediate requirements.

Detroit

Slight improvement in the machinery and machine tool field has been noted by the larger dealers during the past week. Inquiries are coming in larger numbers than for some time past, while more actual sales are being made than at any time since the first of September.

Whether this condition is merely temporary or is but a taste of what may be expected in this automotive center during the remaining weeks of 1924 is largely a matter of conjecture.

There is a disposition of the motor car executives to make the present time a period in which foreign trade can be built up. Export managers are being given more assistance, and manufacturers are hopeful that a large foreign market will enable them to turn out the same production which the motor car industry experienced in 1923.

Within another month it is confidently expected that many of the railroads in this section will place some orders for equipment, but so far "feelers" only have developed.

Just as in the case of the railroads, a feeling persists in the machine tool field that consolidations are imminent in the automobile industry. Some mergers are underway at the present, it is understood in reliable quarters, and no secret is being made by some of the smaller plants that they are anxious to tie up their resources with some of the larger fellows.

Most of the leaders in the automobile industry are laying plans for next year and are determining upon additions in the form of machinery and other equipment. Local leaders in the machine tool field expect that these plans will assume a fairly definite outline before the annual inventory season scheduled for the latter weeks of this year.

Employment figures show that Detroit industries are working on about the same production basis as has been the case for the past six weeks.

New York

Business was not improved in the New York district this week in the machinery and machine tool industry, but dealers were inclined to state that it was no worse than it had been for the past few weeks. Inquiries received would indicate that improvement was due during November, yet nothing of importance is looked for in the way of orders until after election.

Total sales for the month of October did not come up to expectations by any means. The last half of September showed gains which the machine tool men felt would strengthen, but the reverse was the case. Most dealers feel that October can be classed as better than July or August, not as good as September and even a trifle behind th business done last October.

Among the railroad buyers this week were the Chesapeake & Ohio R.R. and the Delaware, Lackawanna & Western R.R. The first named road bought forty tools in the New York district while the Lackawanna purchased on a list of eleven. Other roads in the East bought necessities and small tools.

Machinery used in foundries was in slightly better demand during the week due to the return to work of foundrymen after the heated period of the year. Foundries will be good customers for perhaps another month.

Automobile makers were not in the market during the week in the East and dealers have heard very little from this source during the past month or six weeks.

Used tools were in fair demand and reports are that some of the railroads are looking over used tools for future purchases.

Forger Working Among Machinery Men

Representing himself as an interested prospect for machinery and machine tools and after establishing himself to the satisfaction of several machinery builders, a man giving his name as John E. Morris and his address as New Orleans, La., has been able to pass several worthless checks. The extent of his forgeries has not been learned, but it has been definitely established that he has passed three or four checks in cities some distance from each other.

Morris recently called on Joseph Beal & Co., Boston, Mass., stating that he was from New Orleans and presented a card showing him to be a naval architect and designer. He said that he was interested in salvaging ships in Europe and that he would require much machinery. A few days later he asked officials if they could cash a check for $150 issued by the Baker-Griffith Reo Corp., Newport News, Va. Not only did this check prove to be a forgery, but a few days later the Old Colony Trust Co., Boston, notified the Beal firm that a check supposed to have been issued by the company had been cashed in Columbus, Ohio, by a man giving his name as Harry W. Howard. Howard and Morris are evidently the same man. He is described as five feet tall, weighing about 200 pounds, a ruddy complexion, sandy moustache, three teeth missing in the lower jaw and part of his third finger on the right hand missing. He speaks with a slight English accent. He is evidently well versed in machinery and machine tools.

Opportunity to Secure Ancient Foot Lathe

Word has been received in this country that Doctor Taylor, 20 Sternhold Ave., Streatham Hill, S. W. 2, London, Eng., is offering for sale for $150 a foot lathe said to have been built about 200 years ago. The base is 4x3¼ in., the swing is 1¼x2 in., the T-rest has a quick acting clamp, and there are flywheel and pulley with four grooves in each. It was suggested by Doctor Taylor that this would be a nice acquisition for a museum.

Franklin Institute Awards Medals

At the meeting of the Franklin Institute held on Wednesday evening, Oct. 15, the following medals were presented:

The Louis Edward Levy Medal to Dr. Harvey Fletcher of the Western Electric Co., New York City, for his paper on "Physical Measurements of Audition and Their Bearing on the Theory of Hearing," printed in the issue of the *Journal of The Franklin Institute* for September, 1923. This is the first award of the Levy Medal, which will be awarded annually to the author of a paper of especial merit, published in the journal of the Institute, preference being given to one describing the author's theoretical and experimental researches in a subject of fundamental importance.

The Edward Longstreth Medal was presented to Thomas C. McBride of Philadelphia, for his invention of a locomotive feed water heater.

The Edward Longstreth Medal was also presented to Milton Roy Sheen of Philadelphia, for his invention of the expansion machine for tunnel construction.

All these awards were made by the Institute on recommendation of the Committee on Science and the Arts.

Personals

KARL KENDIG, advertising manager of the Whitman & Barnes Manufacturing Co., Akron, Ohio, has been made secretary of the company.

MICHAEL H. CONNELLY, formerly sales agent of the American Car & Foundry Co., has resigned to become manager of sales for the Albany Car Wheel Co., the Reading Car Wheel Co., and the General Steel Casting & Machine Co. His headquarters will be located at 8 Lister Ave., Newark, N. J.

W. S. JAMES, former research engineer for the Hupp Motor Car Corp., Detroit, has become assistant technologist with the Associated Oil Co. of San Francisco, Calif.

JOHN G. LORING has charge of the newly opened New England office of the Newark Wire Cloth Co., Newark, N. J. The headquarters are at 66 Hamilton St., Cambridge, Mass.

CHARLES R. POMEROY is now a machine designer with the Toledo Machine & Tool Co., Toledo, Ohio.

J. S. PAUL has been made general manager for the Michigan City Foundry & Machine Co., Hinsdale, Ill.

N. D. FARMER, formerly comptroller of the Carborundum Co., has been made treasurer of the Austin Machinery Corp., Muskegon, Mich.

A. K. WARREN has left the General Electric Co., West Lynn, Mass., and will join the Shibaura Engineering Co., Japan.

C. C. WHEATON, formerly advertising manager of the Lancaster Steel Products Corp., Lancaster, Pa., is now engaged in sales promotion work at the Central Steel & Wire Co., Chicago.

I. J. REUTER, president of the Remy Electric Co., Anderson, Ind., has been made president of the Klaxon Horn Corp., which has been moved to Anderson. The Klaxon company is now a division of the General Motors Corp.

GEORGE B. CAMPION, formerly district sales manager at New York of the B. F. Goodrich Co., has been appointed manager of the Goodrich mechanical sales at Akron, Ohio. He succeeds T. A. Bennett, who has been made manager of the products control department, new goods division.

JAMES C. KIRK is not connected with the Borg & Beck Co., Moline, Ill., as was recently stated in the *American Machinist*. Mr. Kirk is with the Rock Island Lines located at Silvis, Ill.

Business Items

The Tobrin Tool Co., Plantsville, Conn., has been established for the purpose of manufacturing screw drivers, pipe wrenches and automotive tools.

The appliance and industrial departments of the Combustion Utilities Corp. and the Surface Combustion Co., Inc., New York, have been merged and will henceforth be known as the Surface Combustion Co. It will also be the utilization division of the Combustion Utilities Corp.

The name of the Sandusky Foundry & Machine Co., Sandusky, Ohio, has been changed to the Paper & Textile Machinery Co.

The John F. Folkers Engineering Corp. Mobile, Ala., has been appointed agent to handle sales and service for the Triumph Electric Co., Cincinnati, Ohio, in the Mobile district.

The Miller & Stern Tool Co., 1,013 Mission St., San Francisco, Calif., has been formed for the purpose of dealing in machine shop supplies. Both Mr. Miller and Mr. Stern were connected with the Harron, Rickard & McCone Co. for many years.

A transaction which has been pending for several weeks disposes of Herbert Nelson's interest in the Frankfort Machine Works, Frankfort, Ind., to three Kokomo residents, C. H. Wills, H. B. Upham and William F. Rose. Charles Bowers, who has been associated with Mr. Nelson, retains his interest in the concern. Under the new management Mr. Upham will be president, Charles Bowers will be vice-president, Mr. Wills will be secretary-treasurer. William Rose will be manager and superintendent of the shop.

Obituaries

MAJOR W. A. GARRETT, general transportation manager of the Baldwin Locomotive Works, Philadelphia, died recently at his home in Moylan, Pa. He had been connected with railroads and railroad work since 1876. During the war Major Garrett was assistant general manager of the Remington Arms Co., Eddystone, Pa. Following the war he joined the Baldwin company.

PATRICK F. BANNON, general superintendent of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., died recently at his home in Waterbury. Mr. Bannon was well known in that section of New England having been prominent in the machine-tool industry for many years.

THOMAS T. HOWARD, 54 years old, owner of the Howard Brothers Boiler Works, Buffalo, died recently in that city. The business was inherited from his father and he had operated it the past 35 years.

BERNARD W. MCKENZIE, president of the Western Metal Supply Co. of San Diego, Cal., died suddenly in that city Oct. 7, aged 66 years.

PATRICK B. DELANEY, inventor and patentee of 150 electrical devices, died recently at his home in South Orange, N. J. He had been the recipient of the Elliott Creson gold medal and also the John Scott Legacy medal of the Franklin Institute.

WALTER M. BACON, president of the American Tool & Machine Co., Boston, died recently at his home in Dorcester, Mass.

Trade Catalogs

Tool and Alloy-Steels. The Carpenter Steel Co., Reading, Pa. This catalog that has been issued by the Carpenter company is leather bound and is one of the most substantial catalogs that has been published by any company for some time. It is catalog "E" and covers completely the company's line of steels with prices and specifications as well as color charts.

Industrial Trucks. The Lewis-Shepard Co., Boston. This company has issued a four-page folder showing by illustration and text the value of the "Jacklift" and other trucks and jacks made by the company. Self-loading trucks, stackers and improved conveyors are featured.

Hydraulic Regulating Gates. The Whiting Corp., Harvey, Ill. Gates used for hydro-electric development are featured in this folder with particular attention to the eighteen gates built for the Laurentide Power Co. and the Shawinigan Water & Power Co.

Magnetic Chucks. The J. & H. Electric Co., 161 Clifford St., Providence, R. I. The folder describes minutely the magnetic chuck made by this company and also the D. & W. Demagnetizer, another product of the company. Both are illustrated and intelligently outlined so that it is not difficult to visualize the appliance.

Polyphase Motors. The Century Electric Co., St. Louis, Mo. The Century Squirrel Cage Induction Motor is described, and specification charts according to number of cycles are also included. The pages are perforated for filing.

Drop-Forged Tools. The Crescent Tool Co., Jamestown, N. Y. The method of manufacture and the products of the company, notably wrenches, pliers, screwdrivers and repair parts are the subdivisions in this catalog. Each tool is illustrated, described and priced.

Vises and Tools. The Erie Tool Works, Erie, Pa. Many kinds of vises used in factories are described and illustrated in this recently issued catalog. Wrenches and other tools made by this company are also included. Prices, specifications and brief descriptions accompany clear cut illustrations.

Screw Products. The Union Screw & Manufacturing Co., Pittsburgh, Pa. Set screws, hexagon and square head screws, flat head and button head screws, milled studs, hexagon nuts, milled coupling bolts, and other screw products of this firm are described in a recent catalog. Tables of size and price are also found.

Heavy Duty Lathe. The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. A booklet entitled "Critical Analysis of a Heavy Duty Lathe," has been issued and is most attractive as well as instructive. Here the important points of a heavy duty lathe are emphasized in a novel manner, taking the form of a questionnaire in which questions and answers are used. Illustrations of lathes and parts are separately mounted on each right hand page.

Worm Gear Speed Reducers. The Horsburgh & Scott Co., Cleveland, Ohio. With illustrations and written description, the product of the company is set forth in a catalog. Advantages of the speed reducer and where it is applicable are told in an interesting and brief manner. Other products of the concern are also described.

Factory Lighting. The Cooper Hewitt Electric Co., 95 River St., Newark, N. J. The application of right lighting for working conditions is told in a booklet entitled "Work-Light," and illustrations help to clarify the text. "CooperHewitts" have been known for many years in most industrial plants and broader usage in all factories has recently been effected.

Automatic Rotary Furnace. The W. S. Rockwell Co., 50 Church St., New York. These furnaces, used for the heat treatment of metal products and other material, are described in a booklet with perforated edge for filing. Diagrams, charts, illustrations and well written text combine to make the booklet instructive.

Johansson Gages. C. E. Johansson, Inc., Division of the Ford Motor Co., Detroit, Mich. This book is a general descriptive catalog of Johansson gages and contains instructions as to the uses of the gages, how to figure combinations and build up the blocks to obtain the desired sizes, how to use the blocks to check themselves, etc. Photographs of the various sets of gages and accessories are shown, with descriptions and prices. The adjustable limit snap gages are also described and illustrated, with instructions for use, checking and sealing and the Johansson tolerance plug gages are described and illustrated, with complete tables of sizes and prices. A number of illustrations of the gages in use are included, showing applications of the different kinds and sizes of gages and recommended manner of handling.

Screws. The Allen Manufacturing Co., Hartford, Conn. The products of this company; hollow set screws, socket head cap screws, socket wrenches, tap extensions and pipe plugs, are described. Tables of diameters and packing weights are included in the booklet.

Hardness Tester. The Wilson-Maeulen Co., Inc., 375 Concord Ave., New York City. This machine and its simplicity are described in a mailing folder recently sent to the trade. A post card is attached to the folder by which industrialists can request a demonstration of the machine.

Pneumatic Tool Repair Parts. The Independent Pneumatic Tool Co., 600 W. Jackson Boulevard, Chicago, Ill. A complete catalog of "Thor" pneumatic tool parts, listed according to a system for which a patent has been applied. A great many Thor parts are interchangeable, and all such parts, as well as the parts that are not interchangeable, are listed with the symbol numbers, names and descriptions in such a manner that the user can instantly determine what tools any part is used on. Assembly drawings of all parts are included to aid in determining the name and part number of each part.

Grinding Wheels. The Norton Co., Worcester, Mass. A booklet entitled "Factors Affecting Grinding Wheel Selection," has been published by this company in which the many requirements for various kinds of work are discussed. The abrasive wheels made by this company are listed and described and a most comprehensive chart shows which type of wheel should be used on different metals in different operations.

Forthcoming Meetings

American Welding Society. Annual Convention, Cleveland, Oct. 30 and 31. Miss M. M. Kelly, 29 W. 39th St., New York City.

National Founders Association. Twenty-eighth annual convention. Hotel Astor, New York City, Nov. 19 and 20. J. M. Taylor, secretary, 29 S. LaSalle St., Chicago.

American Society of Mechanical Engineers. Forty-fifth annual meeting. New York City. Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

Exposition of Invention. Engineering Societies Building, 29 West 39th St., New York City. Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

American Association for the Advancement of Science. Meeting at Washington, D. C., Dec. 29, Jan. 1, 2 and 3. Burton Livingston, Smithsonian Institute, Washington, D. C.

Society of Automotive Engineers. Annual Meeting. Detroit, Mich., Jan. 20, 21, 22 and 23. C. F. Clarkson, 29 W. 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron market is firm at present levels; inquiries, however, are falling off as election approaches. Steel prices continue on the downward course pursued since last March. Steel bars are still $2 and plates, $1.60@$1.90 per 100 lb. at Pittsburgh mills. Structural shapes are quoted at $1.80@$2, against $1.90@$2, one month ago and $2.50 per 100 lb. last year at this time. Railroads throughout the country have ordered steel rails, spikes, bolts and tie plates valued at more than $3,000,000 during the past week.

Non-Ferrous Metals—Electrolytic copper market increasing in strength; no change from price level of Oct. 17. Tin market advancing here and abroad. Lead prices higher; demand greater. Zinc market more active; price up ¼c. per lb. in New York since Oct. 17. Antimony up ¼c. per lb. in week.

Red and White Lead—Prices advanced ¼c. per lb., f.o.b. New York during past week.

(All prices as of Oct. 24)

IRON AND STEEL

PIG IRON—Per gross ton f.o.b.:

CINCINNATI	
No. 2 Southern	$21.55
Northern Basic	21.27
Southern Ohio No. 2	21.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.10
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.34
Virginia No. 2	29.75
Basic	21.25
Grey Forge	21.25
CHICAGO	
No. 2 Foundry local	20.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.60@2.70	3.89	3.45	3.80
No. 12	2.70@2.80	3.94	3.50	3.95
No. 14	2.80@2.90	3.99	3.55	4.00
No. 16	3.00@3.10	4.09	3.65	4.10
Black				
Nos. 17 and 21	3.25@3.35	4.40	4.15	4.55
Nos. 22 and 24	3.30@3.40	4.45	4.20	4.55
Nos. 25 and 26	3.35@3.45	4.50	4.25	4.60
No. 28	3.40@3.50	4.60	4.35	4.50
Galvanized				
Nos. 10 and 11	3.50@3.60	4.60	....	4.60
Nos. 12 and 14	3.60@3.70	4.70	....	4.70
Nos. 17 and 21	3.90@4.00	5.00	....	5.00
Nos. 22 and 24	4.05@4.15	5.15	3.00	5.15
No. 26	4.20@4.30	5.30	4.15	5.30
No. 28	4.50@4.60	5.60	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	6.55
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.15
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.05	3.90	3.80
Cold drawn flats, squares	4.55	4.40	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.75c.; 5/32 to ½, 7.25c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.75
Tin, 5-ton lots, New York			53.00
Lead (up to carlots), St. Louis	8.25@8.50	New York	8.87½
Zinc (up to carlots), St. Louis	6.42½	New York	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.10	28.00	28.50
Antimony (Chinese), ton spot	12.50	13.50	10.00
Copper sheets, base	20.12½	20.37½	23.00
Copper wire, base	18.12½	18.75	21.75
Copper bars, base	19.37½	20.62½	22.50
Copper tubing, base	22.25	23.75	25.75
Brass sheets, base	16.87½	17.12½	19.75
Brass tubing, base	21.00	22.50	28.25
Brass rods, base	14.62½	15.87½	17.50
Brass wire, base	17.37½	19.00	20.25
Zinc sheets (casks)	10.60	11.10	....
Solder (½ and ½), (case lots)	37@38	32.50	30.00
Babbitt metal (83% tin)	60.00	61.50	48@52
Babbitt metal (35% tin)	28.00	19.00	23@26
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54. 00
Manganese nickel hot rolled rods "D"—high manganese (base) 57. 00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32. 00	Hot rolled rods (base)	40. 00
Blocks	32. 00	Cold drawn rods (base)	48. 00
Ingots	38. 00	Hot rolled sheets (base)	42. 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00@11. 50	10. 25	11 00
Copper, heavy, and wire	10. 75@11. 00	10. 00	10 50
Copper, light, and bottoms	9. 50@ 9. 75	9 25	9. 50
Heavy lead	6. 75@ 7. 00	6. 25@6 50	7. 00
Tea lead	5. 75@ 6. 00	5. 25@5. 50	5. 50
Brass, heavy, yellow	7. 00@ 7. 25	6. 50	7. 00
Brass, heavy, red	8. 75@ 9. 00	8. 50@8. 75	8. 50
Brass, light	6. 00@ 6. 25	5. 50	6. 00
No. 1 yellow rod turnings	7. 50@ 8. 00	7. 25	7. 00
Zinc	3. 75@ 4. 00	3. 75	3. 50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23. 50	$22. 85	$21. 00
"A" Grade:				
IC,	20x28, 112 sheets	19. 00	18. 80	17. 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13. 00	13. 00	12 75
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7. 25	6.80@6.90	6.50@6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 14@0. 21	$0. 19	$0. 14
Cotton waste, colored, per lb.	. 09@ .14½	.18	. 10½
Wiping cloths, 13½x13½, per lb	11.00@11.25*	36. 00 per M	. 16
Wiping cloths, 13½x20½, per lb.	....	50. 00 per M	. 16
Sal soda, per 100 lb. keg	2. 25	2. 25	2. 65
Roll sulphur, per 100 lb. keg	3. 60	3. 25	3. 50
Linseed oil, per gal., 5 bbl. lots	1. 08	1. 09	1. 05
Lard cutting oil, 25% lard, per gal.	. 55	. 50	. 32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	. 35	. 21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4. 86	$5. 84	$6. 48
Emery paper	10. 71	11. 00	8. 80
Emery cloth	28. 00	31. 12	29. 48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1. 49	1. 24	1. 40
Cloth	3. 38	2. 67	3 20
Fire clay, per 100 lb. bag	....	. 65	. 60
Coke, prompt furnace, Connellsville	per net ton		3. 00@3. 25
Coke, prompt foundry, Connellsville	per net ton		4. 25@4. 75
White lead, dry or in oil	100 lb. kegs	New York, 15. 00	
Red lead, dry	100 lb. kegs	New York, 15. 00	
Red lead, in oil	100 lb. kegs	New York, 16. 50	

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0405	.0415	.0465
Brass rods	per lb	.1462½	.15	.1525
Solder (½ and ½)	per lb.	.37@.38	.385	.295
Cotton waste	per lb.	.14@.21	.14@.21	10@13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.29	.29	.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	50%	40–10%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	60%
1½ and 1½x3 in. up to 12 in	15%	.....	....
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	35%	$3. 50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	3. 50 net	60%*
Button head bolts, with hex. nuts	10%	3. 50 net	.....
Hex. head and hex. nut bolts	10%	.....	.....
Lag screws, coach screws	45%	.....	65%
Square and hex. head cap screws	75%	75–10%	.....
Carriage bolts, up to 1 in.x30 in.	35%	60%	55%
Bolt ends, with hot pressed nuts	45%	.....	60%
Tap bolts, hex. head, list plus	35%	.....	$4.65
Semi-finished nuts, ⅞ and smaller	70%	.....	.....
Semi-finished nuts, ¾ and larger	65%	70%	.....
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6. 50	$4. 00	$3.75
Washers, cast iron, ¾ in., per 100 lb. (net)	5. 50	4. 00	3.75
Washers, round plate, per 100 lb. Off list	1. 50	5.00	4.50
Nuts, hot pressed, sq., per 100 lb. Off list	1. 50	4.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1. 50	4 00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1. 50	4.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1. 50	4.00	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller.	60%	60–10%	70%
Rivets, tinned	60%	60–10%	70%
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5. 00	$3. 50	$3. 50
Cone heads, ditto (net)	5.20	3.60	3. 70
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0. 25	.....	0.15
¾ in. diameter *EXTRA*	0. 35	.....	0.15
½ in. diameter *EXTRA*	0. 75	.....	0.50
1 in. long, and shorter *EXTRA*	0. 75	.....	0.50
Longer than 5 in. *EXTRA*	0. 50	.....	0.25
Less than 200 lb. *EXTRA*	0. 50	.....	0.50
Countersunk heads *EXTRA*	0. 45	.....	...

*Square.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Mass., Boston—Queensberry Realty Trust Co., 18 Tremont St.—equipment for repair and service garage on Queensberry St.

Mass., Boston—Schoolhouse Dept., City Hall—metal and woodworking machinery for Sherwin District Trade School, Roxbury.

Mass., Cambridge — General Steel & Rubber Stamp Co., Harvard and 6th Sts.—complete plating plant.

Mass., Dorchester — Stilphen Motor Co., 395 Columbia Rd.—machinery and tools for repair garage.

Mass., East Boston—A. DeStefano, Chelsea St.—equipment for repair and service garage.

Mass., Fall River — Terry & Crawford, Blossom St. (blacksmith and repair shop)—miscellaneous machinery and tools.

Mass., Melrose—A. Shepherdson, Crystal St.—16 to 20-in. band saw.

Mo., Doniphan—T. L. Wright Lumber Co.—double drum belt driven hoist, 400 ft. ½ in. cable, two 12 in. pulley blocks and one ½ yd. bucket (used).

N. Y., Brooklyn—P. M. Stange, 64 North 9th St. (Machinist)—3 lathes, 1 milling machine, 1 planer, 2 shapers and 1 drill press.

N. Y., Buffalo—J. Kelles & Son, 1172 Elk St.—equipment for machine shop.

N. Y., Lockport—M. Connor, 39 Niagara St., (plumbers specialties)—one 8 in. Foster Barker, 2 jaw wrenchless truck for No. 4 Warner Swasey screw machine.

N. Y., Lockport—D. S. Roszma, Route 5—combination woodworking machine.

N. Y., New York — New York Central R. R., Grand Central Terminal, C. S. White, Purch Agt.—one power squaring shear for 18 iron or lighter.

O., Cleveland—Board of Education, Rockwell and East 6th Sts., will receive bids until Nov. 10 for machinery for the Collinwood Senior High School. See page 714-B.

Pa., Phila. — Pennsylvania R.R., Broad St. Station., S. Porcher, Gen. Purch. Agt.—one alligator shear.

Tex., Corpus Christi—Pressed Metal Mfg. Co.—machinery for equipping proposed plant.

Vt., Windsor—Windsor Foundry Corp.—power hammer, 100 to 150 lbs., and power shear to cut 1 x 8.

Wis., Algoma—Algoma Panel Co.—woodworking machinery.

Wis., LaCrosse — The Machine Postage Service Co., 1107 West 4th St.,—dies, punch presses, spring wire, etc., for making stamp selling machines at DeKalb, Ill.

Wis., Menomonee Falls — Caeser Sheet Metal Works—sheet metal working machinery including brake.

N. S., Murray—M. I. McDonald, (millright, etc.)—shingle machine and steam saw mill equipment.

Ont., Allison — L. Galbraith—drill press and other equipment for public garage and repair shop.

Ont., Beeton—I. W. Rowe, Main St.—drill press, grinder and air compresser.

Ont., Collingwood—G. Ferguson—machinery and tools for garage and repair shop.

Ont., Collingwood—W. W. Leggatt—machinery for saw mill.

Ont., Cookstown—D. B. McFadden (garage, etc.)—lathe and drill press.

Ont., Cornwall—A. Denesha, Pitt St.—foundry equipment for proposed extension.

Ont., Creemore — G. A. Kerr — planing mill machinery.

Ont., Creemore—Walker Bros.—grinder, drill press, air compressor, etc., for public garage.

Ont., Holland—R. McKinstry—equipment for automobile repair shop.

Ont., Kenmore — D. Carkner & Co. — additional equipment for sash and door manufacturing.

Ont., Moose Creek — Damase Perrier — jointer, mortiser and sander for sash and door manufacturing.

Ont., North Bay—Standard Planing Mills—planing mill machinery and equipment, including planers, band and rip saws, jointers, etc.

Ont., Petersboro — E. Hurtubise, 114 Stewart St.—small lathe, grinder and air compressor for garage and repair shop.

Ont., Port Arthur—R. Hamer, 214 Park St.—woodworking machinery for manufacturing office furniture.

Ont., Saulte Ste Marie—Dept. of Forests and Mines, Parliament Bldgs., Toronto—machine tools, lathe, drill, planer, emery, etc.

Ont., Thornburg—I. L. Lake—lathe, drill press, etc., for public garage.

Ont., Toronto—Hy-lo Jacks, Ltd., L. A. Reeves, Purch. Agt.—mechanical equipment for new factory to manufacture hydro-static jacks.

Ont., Unionville — P. J. Dickson — machinery for sash and door manufacturing.

Ont., Uxbridge—W. J. McMurtry—machinery for manufacturing furniture.

Ont., Virgil — W. D. Lutz — general machinery for manufacturing vehicles, etc.

Que., L'Anse St. Jean (furniture)—woodworking equipment.

Que., Mont Carmel—Polydore Desfardins—planer, sticker, etc. for sash and door manufacturing.

Que., Montreal—W. M. Birks, 14 Philips Sq.—complete equipment for new public garage corner of Cathcart and St. Monque St.

Que., Montreal—J. Lizotte, 279 Iberville St.—complete equipment for service station.

Que., Montreal—C. S. St. Jean, 1660 St. Denis St.—complete equipment for public garage and service station at 225 City Hall Ave.

Que., Montreal—Sealys Trucking Co., 914 Notre Dame W.—complete equipment for public garage and service station.

Que., Montreal—P. Swail, 551 St. Antoine St.—complete equipment for auto repair shop at 64-68 Ovesnel St.

Que., St. Anaclet—L. Jean—sander, saws and other equipment for sash and door factory.

Que., St. Hughes—A. Paquette (church furniture)—woodworking machinery.

Que., St. Urbain—equipment for garage and repair shop to cost about $800.

Opportunities for Future Business

Calif., Los Angeles—Amer. Manganese Steel Co., having plans prepared for the construction of a plant for the manufacture of alloyed steel on Slaussen Ave. and Downey Rd. D. H. Houng, Los Angeles, Archt.

Calif., Los Angeles—Mack International Motor Truck Corp., 1628 East 7th St., awarded the contract for the construction of a 1 and 2 story warehouse and service plant. Cost about $377,990.

Calif., Los Angeles—H. P. Rehbein, 7038½ Hollywood Blvd., awarded the contract for the construction of a 3 and 5 story garage and office building on Sycamore St. Cost about $400,000. Noted Oct. 9.

Calif., San Francisco—Cowell Estate, 2 Market St., will receive bids in Nov. for the construction of a 3 story garage on The Embarcadero. Estimated cost $130,000. H. H. Meyers, Kohl Bldg., Archt. Noted Jan. 10.

Calif., San Francisco — Diamond Patent Show Case Co., 1625 Mission St., awarded the contract for the construction of a 1 story factory on 8th and Howard Sts., cost $45,000. Noted Oct. 9.

Conn., New Haven—Nail Welding Co., is having plans prepared for the construction of a 1 story, 45 x 100 ft. factory building on Dixwell Ave. Estimated cost $40,000. Westcott & Mapes, Orange, Engrs.

Conn., Winsted — Strand & Sweet Mfg. Co., Meadow St., manufacturers of magnet wire, plans a 1 story, 60 x 60 ft. and basement, 40 x 60 ft. addition to factory. Estimated cost $40,000. Architect not selected.

Ind., Evansville — Graham Bros. Motor Truck Co., plans a 1 story addition to auto truck factory on Stringtown Rd. Estimated cost $200,000.

Mass., Fall River—L. Harris, Mohican Garage, Central St., is having plans prepared for the construction of a 1 story, 130 x 120 ft. repair and service garage. Estimated cost $50,000. R. Deardon, 38 Border St., Archt.

Mass., Somerville—H. Rosen, 112 Wisconsin Ave., is having plans prepared for the construction of a 3 story, 130 x 55 ft. garage on Prospect St., Webster Ave. and Newton St. Estimated cost $150,000. Private plans.

Mass., South Boston—Louis Shepard Co., 1st St., manufacturers of material handling equipment, is receiving bids for the construction of a 1 story, 300 x 55 ft. factory on Walnut St. Estimated cost $60,000. Clifford & Roeblad, 101 Tremont St., Boston, Engrs.

Mo., St. Louis—J. DeF Garrison, Kansas City, awarded the contract for the construction of a 1 story, 100 x 200 ft. garage on Scanlan Ave. Peoples Motorbus Co. lessee. Estimated cost $100,000.

N. Y., New York—A. J. B. Realty Corp., 238 William St., A. Brisbane, Pres., will soon receive bids for a 4 story garage at 3 East 102nd St. Estimated cost $150,000. C. E. Roth, 119 West 40th St., Archts. and Engrs.

Pa., Corry—Corry Jamestown Mfg. Co., manufacturer of sheet metal specialties, awarded the contract for a 4 story, 61 x 131 ft. addition to factory. Estimated cost $65,000. Noted Oct. 2.

Pa., Philadelphia—A. Finkenberg's Sons, 2279 3rd Ave., New York, awarded the contract for the construction of a 6 story, 200 x 110 ft. warehouse and garage on Willow Ave. Estimated cost $350,000.

Pa., Pittsburgh—Pittsburgh Railway Co., 435 6th Ave., plans a 1 story, 156 x 231 ft. car barn and shop addition on 2nd Ave. Private plans.

R. I., Providence—Jos Pollock, c/o A. J. Frappier, 316 Strand Bldg., Archt., is having plans prepared for the construction of a 2 story, 62 x 67 ft. factory at Chestnut and Basset Sts. Estimated cost $40,000.

Wis., Marshfield — Marshfield Hardware & Auto Co., is having plans prepared for the construction of a 2 story, 80 x 100 ft. shop and warehouse. Estimated cost $75,000. G. A. Krasin, Central Ave., Archt.

Ont., Saulte Ste Marie—Dept. of Forests & Mines, Parliament Bldgs., Toronto, awarded contracts for the construction of a 1 and 2 story, 80 x 350 ft. aerdrome and machine shop. Estimated cost $150,000.